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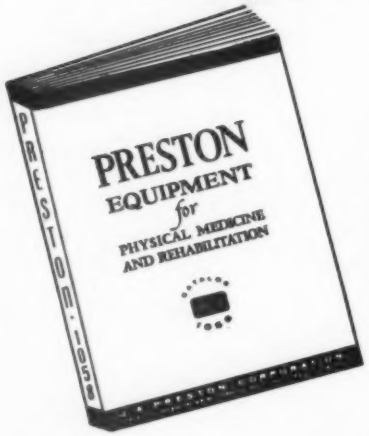

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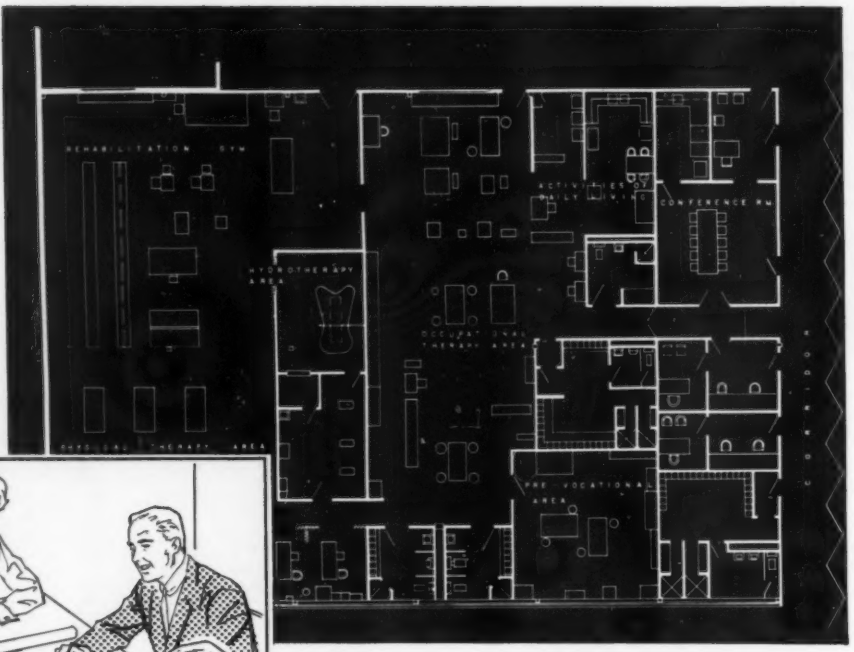

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The Nature of Cardiovascular Condition in Normal Humans, Part 3 — Thomas K. Cureton, Ph.D., F.A.P.H.A. 41

Exercise Therapy — Nancy Salter, B.Sc. 50

The Effects of Exercise on the Reduction of Body Weight — Joan Evans, M.S., Leo Ellison, M.S. and Edward K. Capen, Ph.D. 56

PM&R Treatment Aims for NP Hospitals: A Simplification — Richard C. Cowden, Ph.D. and Richard G. Hannon, C.C.T. 60

DEPARTMENTS

FROM OTHER JOURNALS 64
BOOK REVIEWS 66
CHAPTERS 69
NEWS AND COMMENTS 69
C.T. BIBLIOGRAPHY 70
CLASSIFIED DIRECTORY ..... Back Cover

THE JOURNAL OF THE ASSOCIATION FOR PHYSICAL AND MENTAL REHABILITATION

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THE NATURE OF CARDIOVASCULAR CONDITION IN NORMAL HUMANS (PART 3)

THOMAS KIRK CURETON, Ph.D., F. A. P. H. A. *

Cardiovascular Component III—Efficiency In A Sub-Maximal Work Task

The Sub-Maximal Work Task

When a man walks all day, takes a swim of several miles, or rides a bicycle for four hours without stopping, there usually develops the "steady state," which means that adjustment has been made to the work by circulation-respiration, and no oxygen debt develops. In young men this state is obtained when walking at about four miles per hour for fifteen minutes. The curves of oxygen intake level off, as do the pulse rate and blood pressure and respiration curves. Body temperature may rise very slowly as the work goes on for more than thirty minutes.

There are many such sub-maximal work tasks about the home, office or factory. As a rule sport participation is more violent and intermittently drives one into an oxygen deficiency, then rest permits recovery. Even baseball, with its sudden dashes around the bases, or the run to catch a long fly, may cause oxygen deficiency in a few seconds. An army on a long march, however, works at a fairly steady state. Several studies have been made of long marching. Tables are also available showing the energy cost in Calories/Hour or Cal./Hr./Kg. of various work tasks over a wide range of human physical activities.

The Sub-Maximal Test of Efficiency

While it is best in the laboratory to record the pulse rate, blood pressure, oxygen intake, rectal temperature, respiration and perspiration over a long period with observations taken from time to time, or even continuously, such testing is not practical in the clinical situation. The best clinical test which can be applied without elaborate equipment is probably the *Progressive Pulse Ratio Test*. The *Pulse Ratio* is the ratio of the quiet sitting pulse rate before exercise divided into the total pulse count for two minutes taken from ten seconds after the exercise. Such a test has been standardized from observations taken before and after various rates of stepping up an down on a 17-inch bench. The rates are at 12, 18, 24, 30 and 36 steps per minute. Beyond a doubt, if such a test were given at the beginning and at the end of a working day, the decrements (losses) would indicate fatigue. Higher pulse rates would indicate that the work imposed for a definite period could not be done as economically as when the pulse rates were relatively lower.

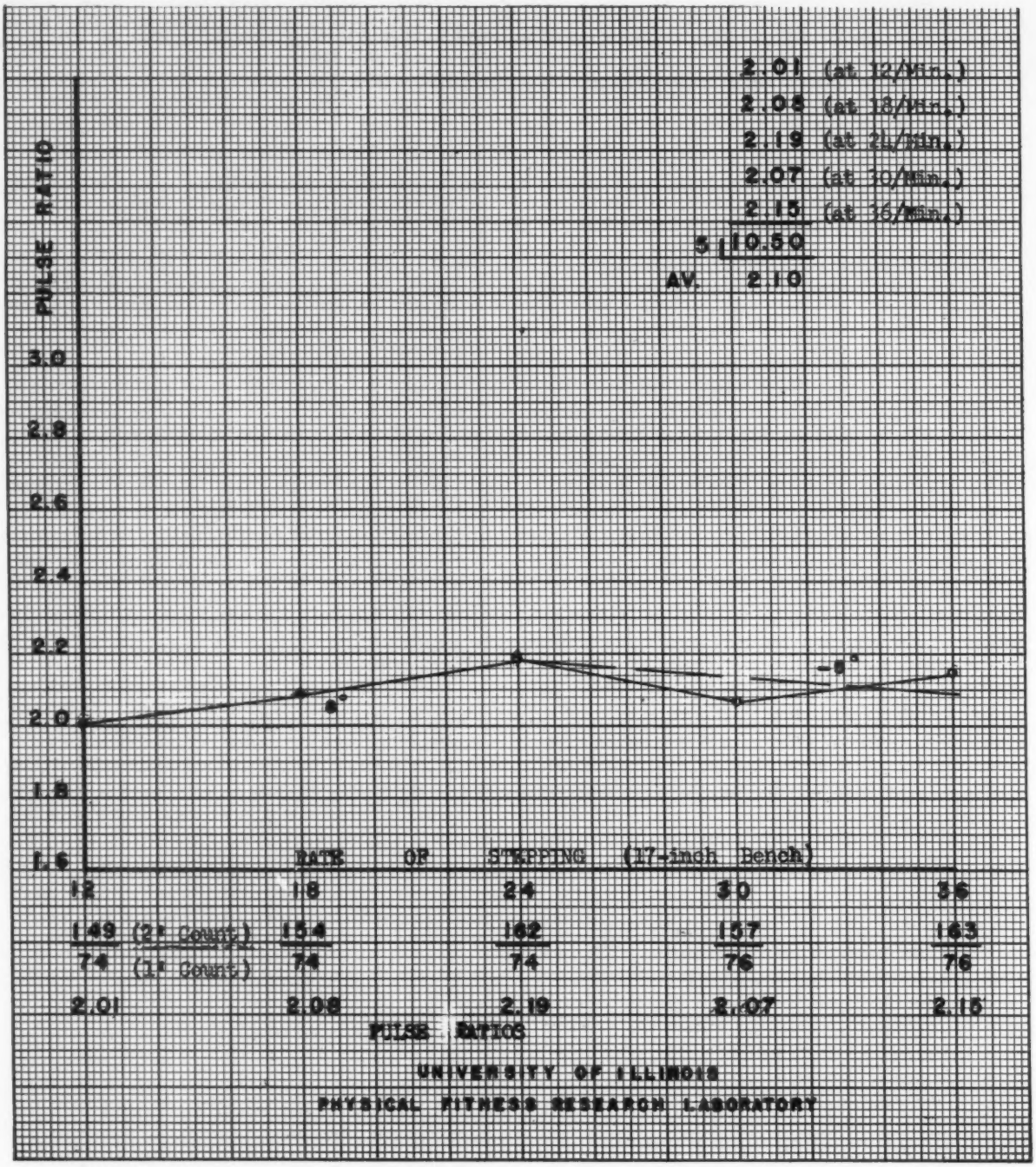
Considerable experimentation has been carried out with such a *Progressive Pulse Ratio Test* at the Physical Fitness Research Laboratory, of the University of Illinois, at Urbana. The test has been found very useful to determine the point of "Break," indicating the rate at which oxygen deficiency develops rather suddenly. With older people, or non-athletic subjects, the test is very valuable to see how a person can adjust to rather simple work. Stepping up and down on a 17-inch bench has been shown to be quite satisfactory but every precaution should be taken to see that the bench is firm, preferably a built-in bench, made of heavy wood.

Fig. 14 illustrates the procedure with a subject who made an almost perfect adjustment to the progressive work tasks imposed. From 12 to 24 steps per minute, there was a gradual but very slight rise in the recuperation pulse counts, (149, 154, 162) with the base pulse returning to normal each time within the 2-minute recuperation time. Then at 30 steps per minute there was a slight warm-up effect with a lowering of the recuperation pulse to 157 and the ratio also, but the pulse was 76 even after waiting five minutes during recovery. At 36 steps per minute the recovery pulse and also the ratio begin to climb very gradually; however, not enough to be associated with real oxygen debt. This curve, therefore, represents a very efficient adjustment to the work. In sub-maximal work such a person would have a low pulse rate, low recovery pulse for the 2-minute period, would show little breathlessness and would be economical in the use of oxygen compared to a person in poorer condition. The average pulse ratio is a quite good cardiovascular test of Component III. To meter relative efficiency in sub-maximal work it is as good as any known test.

Decrement Tests Measure Fatigue

The fatigue (tension) over a working day is measurable in terms of decrements in such measures

*Professor of Physical Education, Director of the Physical Fitness Research Laboratory, University of Illinois, Urbana.



PROGRESSIVE PULSE RATIOS VS. RATE OF STOOL STEPPING

FIG. 14

as: (1) Decreases in the brachial pulse waves (heartograms); (2) Decreases in critical flicker fusion frequency (Krasno-Ivy Flicker-Meter); (3) Strength; (4) Flexibility; (5) Increases in 0^2 Intake; (6) Decreases in postural height or other postural measurements; (7) Decreases in the amplitude of the precordial T-Waves of the ECG; (8) Increases in circulatory ptosis from lying to standing, or from sitting to standing; (9) Increase in white corpuscle count; (10) Decrease in eosinophil count.

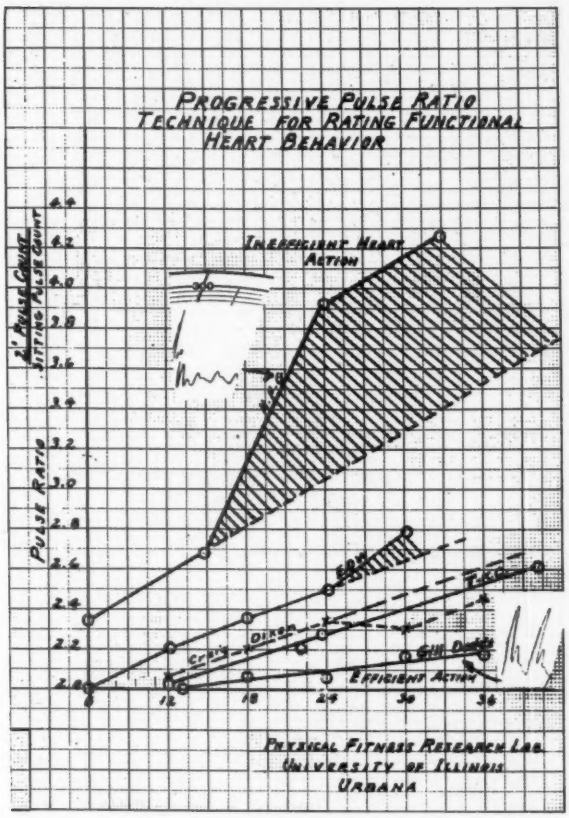


FIG. 15

Fig. 15 shows the comparison of several subjects in various states of cardiovascular fitness. Subject H.F.G. is a physician in very poor condition. (This must not be interpreted as having anything to do with heart disease, as only functional efficiency is implied). He was typically a sedentary man, working in a small office with very few home calls. On most days he stayed in his office all day. His brachial pulse wave was also feeble. Even at 12 steps/min. he gave a relatively higher recuperation pulse and ratio. By contrast with a very efficient subject (Gil Dodds, the mile champion), the difference can be easily seen. Dodds adjusted very well to every rate of work, all ratio points plotting in a virtual straight line without sudden "Break." Here the pulse rates are proportional to the work done and recovery is quite complete. But the shaded area indicates a "Break" and is associated with the sudden development of an oxygen defiency.

The subjects between Dodds and H.F.G. are intermediate between the extremes but are quite good. With subject H.F.G. the cross-hatched area indicates the loss in efficiency. In sub-maximal work the efficiency varies widely. In a study in our laboratory by Mary D. Gray (1952) oxygen intake and oxygen debt were determined at every rate of stepping by a number of subjects varying widely in fitness. Whenever there was an early and sudden "Break" in the slope of the plotted line through the points from 12 to 36 steps/min. there were corresponding increase of oxygen debt or decrease in oxygen intake. The procedure is excellent as a fairly quick clinical procedure to analyze the relative efficiency of an individual in terms of his capacity to adjust to the progressive work. It takes about one-half hour to analyze an individual.

The results are very much more reliable than ordinary quiet pulse rate, blood pressure, or oxygen intake tests. The five-minute (Harvard) Step Test is too hard for many middle-aged or hospitalized subjects, but this "progressive pulse ratio" procedure can usually be applied with success to judge the relative ease and quickness with which the subject can adjust to the work tasks imposed.

Validation Studies

Cureton correlated the average pulse ratio with gross oxygen intake and found significant relationship (Fig. 16) and reported in 1950 (Proceedings, A.A.H.P.E. & R., pp. 126-127, Dallas, 1950) that the test had considerable value when properly applied. Obtaining 5 points in progression, the scoring techniques and standardized graph (Keuffel and Esser, No. 358-11 graph paper, 7"x10" with 10 x 10 to the ½ inch, 5th lines accented), and the validation against oxygen intake and oxygen debt at every rate of stepping were all new developments since Hunt and Pembrey (1921) and also Campbell (1927) working at Guy's Hospital, London, had introduced the simplified pulse ratio, and this was then further studied by W. W. Tuttle at the University of Iowa (1931) and validated by Franklin M. Henry and Frank L. Kleeberger at University of California (1938). The assumption that pulse rate is proportionate to work done generally holds up until a real oxygen debt develops, then it does not hold. Deviations in hard work are common in normal undiseased subjects just due to oxygen insufficiency; and, likewise, the recovery pulse rates lose their proportionate relationship and become unreliable indicators of efficiency or performance capacity.

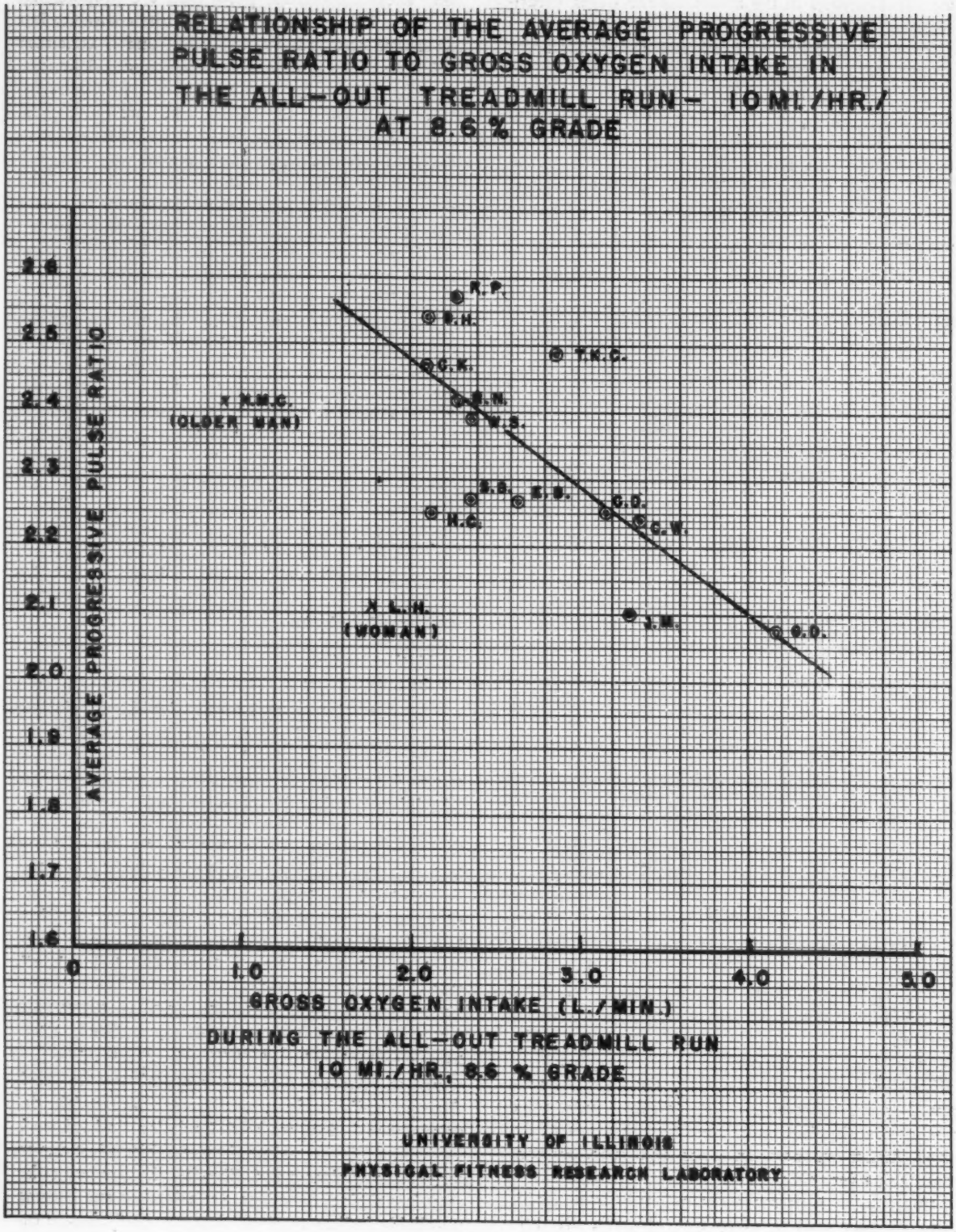

RELATIONSHIP OF THE AVERAGE PROGRESSIVE PULSE RATIO TO GROSS OXYGEN INTAKE IN THE ALL-OUT TREADMILL RUN- 10 MI./HR./ AT 8.6 % GRADE
AVERAGE PROGRESSIVE PULSE RATIO
2.6
2.5
2.4
2.3
2.2
2.1
2.0
1.9
1.8
1.7
1.6
R.P.
B.H.
T.K.C.
C.K.
E.N.
W.S.
X K.M.C. (OLDER MAN)
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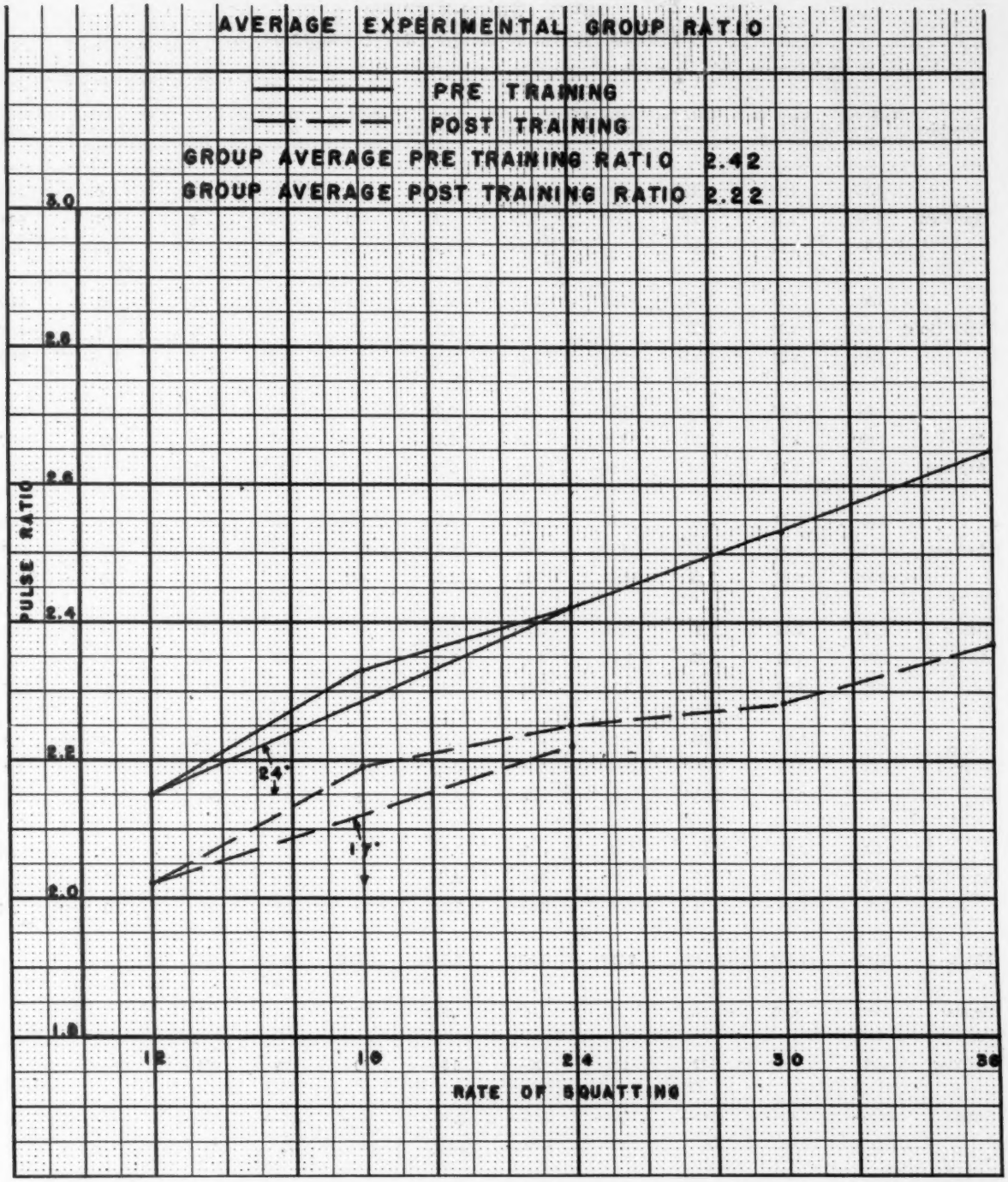
FIG. 16



SLIGHTLY REDUCED

CHANGES DUE TO ATHLETIC TRAINING (ATHLETES)

FIG. 17

ADULT MEN (26-60 YEARS)

PROGRESSIVE PULSE RATIO TEST (CURETON)

Classification	Ratio for 12 Steps per min.	Ratio for 18 Steps per min.	Ratio for 24 Steps per min.	Ratio for 30 Steps per min.	Ratio for 36 Steps per min.	Avg. Ratio of 5 Ratios	Angle Between 24 & 30 Steps/min.	Angle Between 30 & 36 Steps/min.	Avg. Angle*	Standard Score	Percentile
	1.72	1.73	1.72	1.79	1.62	1.86	0	0	1	100	99.9
Excellent	1.76	1.78	1.80	1.88	1.76	1.93	0	0	5	95	99.7
	1.80	1.84	1.88	1.98	1.90	1.99	0	0	8	90	99.2
	1.85	1.90	1.95	2.07	2.03	2.06	3	4	12	85	98.2
Very Good	1.89	1.96	2.03	2.16	2.17	2.13	8	9	16	80	96.7
	1.93	2.02	2.10	2.26	2.31	2.20	13	15	19	75	93.3
	1.98	2.07	2.18	2.35	2.45	2.26	18	20	23	70	88.4
Above	2.02	2.13	2.26	2.45	2.59	2.33	24	26	26	65	81.6
Average	2.07	2.19	2.34	2.54	2.73	2.40	29	31	30	60	72.6
	2.11	2.24	2.42	2.63	2.87	2.46	34	36	33	55	61.8
Average	2.15	2.30	2.49	2.73	3.01	2.53	39	42	37	50	50.0
	2.20	2.36	2.57	2.82	3.15	2.60	44	47	40	45	38.2
Below	2.24	2.42	2.65	2.92	3.28	2.66	49	53	44	40	27.4
Average	2.28	2.48	2.72	3.01	3.42	2.73	54	58	48	35	18.4
	2.33	2.53	2.80	3.10	3.56	2.80	59	64	51	30	11.5
	2.37	2.59	2.88	3.19	3.70	2.86	64	69	55	25	6.7
Poor	2.42	2.65	2.96	3.29	3.84	2.93	70	74	58	20	3.6
	2.46	2.70	3.03	3.39	3.98	3.00	75	80	62	15	1.8
	2.50	2.76	3.11	3.48	4.12	3.06	80	85	65	10	.82
Very Poor	2.55	2.82	3.19	3.57	4.26	3.13	85	91	69	5	.35
	2.59	2.88	3.26	3.67	4.40	3.20	90	96	72	0	.14
Mean	2.154	2.303	2.493	2.728	3.007	2.530	38.9	41.96	36.9		
Sigma	.145	.186	.258	.314	.463	.223	17.08	18.10	11.9		
Number	116	116	113	113	96	85	90	74	64		
Range	1.60— 2.44	1.90— 2.84	1.90— 3.29	1.90— 2.88	2.10— 4.70	2.06— 3.28	0— 80	0— 79	12— 76		

*Average angle found as follows: Plot average ratio of 24 steps/min. Draw line from ratio of 2.0 through average ratio. Measure angle of line from 2.0.

TABLE V

ADULT MEN (26-60 YEARS)

RATING SCALE FOR PROGRESSIVE PULSE RATES

Classification	Total 2' pulse Count After 12 Steps/min.	Total 2' pulse Count After 18 Steps/min.	Total 2' pulse Count After 24 Steps/min.	Total 2' pulse Count After 30 Steps/min.	Total 2' pulse Count After 36 Steps/min.	Standard Score	Percentile
	71	77	84	98	105	100	99.9
Excellent	80	86	94	109	118	95	99.7
	89	95	104	119	130	90	99.2
	97	105	114	130	143	85	98.2
Very Good	106	114	124	141	156	80	96.7
	115	123	134	152	168	75	93.3
	123	132	144	162	181	70	88.4
Above	132	142	154	173	193	65	81.6
Average	141	151	164	184	206	60	72.6
	149	160	175	195	218	55	61.8
Average	158	169	185	203	231	50	50.0
	167	178	195	217	244	45	38.2
	175	188	205	227	256	40	27.4
Below	184	197	215	238	269	35	18.4
Average	193	206	225	249	281	30	11.5
	201	216	235	260	294	25	6.7
Poor	210	225	245	271	306	20	3.6
	219	234	255	281	319	15	1.8
	227	243	265	292	332	10	.82
Very Poor	236	252	276	303	344	5	.35
	245	262	286	314	357	0	.14
Mean	157.9	169.3	184.6	205.8	231.0		
Sigma	28.9	30.8	33.6	36.03	41.9		
Number	115	114	113	112	96		
Range	100—	100—	120—	120—	120—		
	226	238	306	309	370		

TABLE VI

Vincitore[24] (1951) studied 14 adult sedentary men with the *Progressive Pulse Ratio Test* before and after going through six months of combined calisthenics and volleyball, three times per week for an hour. Four men were used as controls who did not exercise. Twelve of the fourteen men improved their pulse ratio graphs from 0.83 to 6.2%. No improvement was shown in the control group. The curve through the average pulse ratio point improved 7°, or 15%. The conditioning program generally lowered the average pulse ratio, postponed the "Break" and reduced the angle through the mean pulse ratio in eight subjects but in none of the subjects was the "Break" completely eliminated. Some subjects changed insignificantly.

A similar improvement in a group of six graduate students who took hard interval training for twelve weeks is shown in Fig 17, the experiment conducted by Cureton in 1951. Four control subjects changed insignificantly.

Mary Dent Gray[25] studied the oxygen intake and debt on each point in various types of subjects. She concluded that under 30 steps per minute the work for her subjects was sub-maximal, but on the 30, for some, and on the 36, for all, *work* changes to *maximal work* with parallel development of the ratio of oxygen intake and oxygen debt. Her cases are very convincing in showing that the whole *Progressive Pulse Ratio Test* is of great value. The point at which an individual developed appreciable distress shows as the work is progressively done and plotted. It is not necessary to push a person suddenly into severe "All-Out" performance. The progressive pulse ratio technique permits a gradual advance in the dosage and is admirably adapted to subjects out of training. It is not adequate for the very best athletes who may be pushed to "All-Out," which is better shown by Component IV and V.

The slope of the pulse ratio line or the standard score ratings on the pulse counts before the "Break" occurs, or the ratings on the recovery pulse rates before the "Break" show the efficiency on the submaximal work. After the "Break" the work becomes maximal and produces quick distress. The average pulse ratio represents the average adjustment to the entire range of the work. The sub-maximal part of the test has a proportionate counterpart in the oxygen cost (L./Min./Kg.) for each of the ratios below the "Break." Several studies show that the test is not highly correlated with those representing other components.[26,27] The terminal angle is most highly correlated with the oxygen cost after the "Break."

Methods of Scoring

There are several ways of scoring the plotted lines for the *Progressive Pulse Ratio*. The initial pulse ratio at twelve steps per minute is not very reliable. The average pulse ratio is much better, taken as the average for the five ratios at 12, 18, 24, 30 and 36 steps per minute. While the angle of break and angle of inclination are of interest, the last terminal angle which can be obtained is the best single item to take and convert to a standard score. The plotted graph is very meaningful to any individual. Tuttle standardized the single *Simplified Pulse Ratio* at 30 steps per minute. This does not show the entire picture, nor the range of work to which the individual could adjust. (Refer to Scoring Table–Table V).

The results may be scored in terms of pulse rates taken for two minutes beginning ten seconds after completion of the stepping. Standardized instructions for this procedure were worked out in 1948 by Cureton. Several studies have been made of this procedure which have thrown light upon the best way to analyze an individual. The usual way is to test the person at each stage (rate of stepping) and plot the results in terms of pulse ratios against the rate of stepping (or squatting) on a standardized piece of graph paper.

The rating sheets should then be encircled, showing on one profile chart the profile for pulse counts and on the other the profile for the pulse ratios. The relative efficiency is shown at a glance on the plot. If the plotted line is at a low angle, low on the chart and remains low for several intervals, then there is

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[24]Michael A. Vincitore, "The Effects of a Physical Conditioning Program on the Progressive Pulse Ratio Test of Adult Men," Urbana: M.S thesis, Physical Education, University of Illinois, 1951. Pp. 62. (Sponsor: T. K. Cureton).

[25]Mary Dent Gray, "The Progressive Pulse Ratio Test in Relation to Oxygen Intake and Oxygen Debt," Urbana: M.S. Thesis, Physical Education, University of Illinois, 1952. Pp. 38. (Sponsor: T. K. Cureton).

[26]George S. Kapas, working at the Physical Fitness Laboratory of the University of Illinois in 1952 completed an M.S. thesis in which he correlated 13 other items representing cardiovascular condition with the average pulse ratio, the average angle of inclination, and then correlated the 30 step/min. ratio and the 36 step/min. ratio with each of the 13 tests. Only at the 36/min. rate of stepping did any significant correlations develop, a —.34± .083 with the Barach Index (high Barach with a low ratio) and another of —.33± .082 with the diastolic surge of the heartograph (low ratio with high diastolic surge). He concluded that the Average Progressive Pulse Ratio represented a different component than was present in the various quiet cardiovascular tests of Component I (Schneider Index, T-Wave and R-Wave of the ECG, sitting heartograph, Barach Index, Stone, Tigerstedt, Erlanger-Hooker, Flack breath-holding and BMR).

[27]Edward F. Ware, in the same laboratory in 1952, showed that the average angle of inclination of the average pulse ratio line correlated 0.478 with resting venous blood pressure, indicating the low venous blood pressure in the quiet state was better than higher venous blood pressure.

great efficiency as shown on the one given for the champion. The poorly conditioned individual gives a line which rises much more sharply and then usually "Breaks" upward, indicating loss of the ability to adjust to the work. At the "Break" the individual makes a transition from the sub-maximal physiological state to the maximal exercise state. This means that he is now developing a real oxygen deficiency and cannot last very long. As he tenses up in the final stages of the work, the oxygen intake rate decreases. It is very important to determine the point at which the "Break" occurs.

Specifications For Progressive Pulse Ratio Test (Steps or Squats)*

1. (a) Seat subject five minutes. Count sitting pulse for 30 secs.

   (b) After 30 secs. count sitting pulse for 30 secs. again.

   (c) If pulse is stable (± 1 beat) go on with the test. If not, count sitting pulse again and continue until two successive counts are the same. If there is still fluctuation, use the average. (Record the actual stable pulse rate but do not wait more than 5 mins.)

2. Have the subject stand up. Count out the timing of the stepping at 5 seconds for each complete trip (12/min.), 2½ secs. *up* and 2½ secs. *down*. Demonstrate. Ask the subject to count the number of trips he makes in one minute at 12/min. Start the subject on the even minute at the start of one revolution of the minute hand on a stop watch or suitable photo-timer. Count for the subject so that one complete trip coincides with 5 secs. on the clock. Continue stepping for exactly 1 min. Tell the subject to sit down. Then after 10 secs., count pulse for 2 min.,*i.e.*, begin the pulse count exactly 10 secs. after the even minute.

3. Compute the pulse ratio and plot the second point while the subject remains seated. Recheck the sitting pulse rate at least twice. Continue until the pulse is stable (± 1 beat) and record in terms of beats/min.

4. Count the rate of stepping at 3.33 secs. for one complete trip, 18/min. Three trips in 10 secs. Demonstrate. Ask the subject to count the number of steps or use a pulse counter. Step the subject at this rate for exactly 1 min. At the end, seat the subject and after 10 secs., count the pulse for 2 mins. Compute the pulse ratio and plot the point.

5. After 2 to 3 mins. check pulse at least twice for 15 secs. Continue until the pulse rate is stable. Record the sitting rate.

6. Explain the rate of stepping at 24 steps/min., 2½ secs. per trip. Demonstrate. Ask the subject to count his trips. Step the subject for exactly one min. Sit the subject down and after 10 secs. count the pulse for 2 min.

7. Repeat step 5.

8. Explain to the subject the rate of stepping at 30/min. Demonstrate, one sec. *up* and one sec. *down*. Ask the subject to count the steps (dips). Step the subject for exactly one min. Sit the subject down and after 50 secs., count the pulse for 2 mins. Compute the pulse ratio and plot the 4th point.

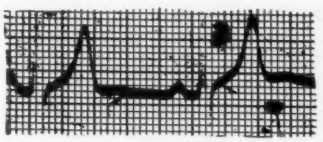
9. Recheck the sitting pulse rate at least twice and continue until the pulse is stable. Record the sitting rate.

10. Explain the rate of stepping at 36/min. Demonstrate or count out three trips *up* and *down* in 5 secs. Ask the subject to count the number of steps and step the subject for exactly one minute.

*Steps up and down on a 15-17" stool or bench. An alternate test may be done with full knee-bend squats, standing with one foot a few inches ahead of the other, finger tips touching the floor on each dip. The present tables, however, apply strictly to the stepping procedure. The squatting table will be presented later.

ERRATUM

Thomas Kirk Cureton, "The Nature of Cardiovascular Condition in Normal Humans, Part 2, 12:1:



The fourth cut, Col. 1, P. 11 was reversed and should have appeared as at left.

In the description of the Crampton Index, Col. 2, P. 12, the Paragraph should read:

Analysis of the Crampton Index by statistical methods shows that the increase in pulse rate has somewhat *less* influence than the change in systolic blood pressure:

$$\text{Crampton Index} = 0.56\,(\text{Change in Pulse Rate}) + 0.71\,(\text{Change in Systolic B.P.})$$

AMERICAN BOARD FOR CERTIFICATION OF CORRECTIVE THERAPISTS

Addendum to 1957-58 Registry

The following names were inadvertently deleted from the Official Registry listed in this Journal 12:6:29-31, Jan.-Feb., 1958. Members whose names appear below are all in good standing.

Illinois

Jacob V. Klein
Stanley E. Schofield

New York

Regina Birnbaum
Gunnar E. Ohberg
John Pistor

California

David Anderson

Maryland

Lansing C. Hills

EXERCISE THERAPY *

NANCY SALTER, B. Sc. **

That the power of normal muscle groups can be improved by constantly practising tasks involving strength has been known for centuries. One may recall the legend of Milo of Crotona, who is reputed to have lifted a calf every day until it had grown into a bull. Similarly it has long been held that practice of a particular skill involving endurance and co-ordination improves that skill and, to a lesser extent, increases endurance and co-ordination in other tasks.

Gardiner[1] traced the development of athletic exercises in ancient Greece, beginning with the sixth century B.C. At this time exercises were connected with military training and the maintenance of physical health and vigour, and weight-lifting is known to have been popular for developing strength and physique. Diet and healthy living were considered an important part of training, but specific exercises were not carried out till the rise of professionalism several centuries later. The practice of skills, such as throwing the javelin, was carried out both as military training and in preparation for athletic festivals. Gardiner mentions that by the second century A.D. a regular system of dumb-bell exercises was in existence for strengthening various parts of the body.

The earliest work in English on the value of physical exercise is Sir Thomas Elyot's *The Governour* (Armytage, 1952). Elyot was influenced by the new knowledge and appreciation of human anatomy in the early sixteenth century, and was well aware of the value of exercise in developing "hardness, strength and agilitie." Ling, the creator of Swedish gymnastics who lived at the end of the last century, successfully reintroduced medical and remedial gymnastics, realizing the value of exercise in abnormal as well as normal conditions. According to Plato, the science of medical gymnastics was invented in the fifth century B.C. by Herodicus of Selymbria!

During the last fifty years physical education has become increasingly important both in schools and in the field of competitive sport, and the knowledge gained in these spheres has been of considerable value to those concerned with prescribing exercises for both normal and diseased muscles. The use of therapeutic exercise in rehabilitation has increased progressively over the last forty years. This is due to the problems produced by the large number of war injuries, the increasing incidence of road accidents, and the prevalence of poliomyelitis and degenerative joint disease. Some research has been carried out on the problems of exercise therapy in rehabilitation, but the basis of most of the techniques in common use is largely empirical. Further work is in progress to determine optimum methods.

Aims of Exercise Therapy

The aim of theraputic exercises is to improve the functional capacity of general "usefulness" of muscles or muscle groups. The importance of the psychological effect of therapeutic exercises is not discussed in detail. Assuming the range of movement to be within normal limits, the usefulness of a muscle group depends on three factors: strength, endurance and co-ordination. Strength is measured as the absolute force the muscles can exert in single contractions. This is perhaps usually the main function of these exercises, but strength is of limited value if the muscle has no endurance. Endurance is the ability of the muscle to maintain a contraction over a period of time or to make repeated exertions through a given range at a given rate over a period of time. Co-ordination is defined as the ease with which contractions can be made speedily and accurately. This paper is not concerned with conditions in which lack of co-ordination is the major force—e.g. disseminated sclerosis. Co-ordination is considered only in so far as it is associated with muscle weakness.

Until recently scant attention has been paid to these three factors. The optimum exercises for developing each property of the muscle are still far from being clearly defined.

Exercises for weakened muscles here considered fall into two groups: (1) muscles which are weak from disuse—e.g. following immobilization or trauma; and (2) those which are partly paralyzed or in which reinnervation is progressing—e.g. after suture of a nerve lesion or following acute poliomyelitis. Therapeutic exercises normally form only part of the total treatment. In many rehabilitation centres a policy of full-time intensive treatment with varied routines of specif-

* Reprinted from *Annals of Physical Medicine*, 4:3:81-93, August, 1957 with kind permission of the Editor.

** From the Medical Rehabilitation Unit, R.A.F., Chessington, England.

[1] E.N. Gardiner, *Athletics of the Ancient World*, Clarendon Press, Oxford, 1930.

ic remedial exercises, remedial games, physiotherapy, and occupational therapy is now followed.

Techniques of Therapeutic Exercises

Certain features of therapeutic muscular exercise are agreed upon. It is generally accepted that exercises for building up strength, endurance and co-ordination should consist of active voluntary movements so that the neuromuscular system acts in the normal physiological way.[2,3,4,5,6] It must be remembered, however, that there is no experimental proof that in man electrically induced contractions are not as effective as voluntary exercise. Work in progress at this centre suggests that electricity can provoke a contraction equal in strength to a maximal voluntary contraction. The obvious criticism of electrotherapy is the lack of patient participation, which may well be of importance in laying down central movement patterns.

Most workers agree that active exercise should be progressive[7,8,9]—i.e. that more effort should be required of the muscle as it improves.

The amount of resistance recommended by different authors varies widely, and there is also disagreement concerning the range of movement through which the muscle should be exercised and the number and spacing of both individual muscle contractions and exercise sessions. The last two factors, together with the resistance applied, determine the degree of fatigue (decrement in applied muscle strength) which will result from an exercise session. The question of the amount of fatigue which is necessary or desirable has yet to be resolved.

Very few exercise routines are described in detail in the literature; it is more usual to find broad principles which may be followed with variations to suit individual requirements. The simplest exercise consists of repeated static contractions—e.g. quadriceps setting. This is useful when no joint movement is possible. The simplest form of progressive isotonic exercise is that in which gravity provides the required assistance or resistance to muscular contraction. Very weak muscles may initially be assisted to complete the range of movement merely by the elimination of gravity. From assisted movements the patient progresses to free movements, and from there to movements against gravity and gradually increasing resistance. Delicate grading of gravity resistance can be achieved by the patient moving the limb over a powdered board, the angle of which can be altered to provide the required degree of assistance or resistance.[10]

DeLorme's Routine

A number of exercise programmes are concerned with weight-lifting, the routine being derived in some measure from training programmes used by professional weight-lifters. The most carefully described exercise routine of this type is one recommended by DeLorme.[11] He emphasized that therapeutic exercise should be classified according to the quality developed in the muscle, and that his "high resistance—low repetition" exercise developed power (strength) while "low resistance-high repetition" exercise developed endurance. DeLorme's routine was devised originally for the quadriceps, but the principle is applicable to almost any muscle group. The exercises are based on a load called the "10 repetition maximum" (10 R.M.), which is the greatest load that can be lifted ten times through the full range of movement. This is determined by carrying out a number of "sets," a set consisting of ten consecutive lifts through the complete range. The subject starts with a set using a relatively light fixed load, and after a one-minute rest the set is repeated with a slightly heavier load. This routine is repeated with a fixed increment in load until ten contractions through the whole range cannot be made. In this way the 10 R.M. is always determined under comparable conditions of warming up and fatigue.

DeLorme's exercise originally consisted of seven to ten sets, starting with a proportion of the 10 R.M. and gradually increasing the load so that the final set was done with the 10 R.M. Later this routine was modified to three sets, using ½, ¾, and 1 x 10 R.M.[12] The patient is instructed that the load should be lifted smoothly and rhythmically through the full range, a short pause being allowed between lifts and a one-minute pause between sets. The exercise session, consisting of three sets, is repeated on four days a week, a new 10 R.M. being assessed on the fifth day. The 1 R.M. (maximum load that can be carried through the whole range) is also measured weekly.

The schedule was originally given the name "heavy resistance exercise," but this was later changed to "progressive resistance exercise" (P.R.E.) because the term "heavy" was misleading, the load not necessarily being heavy in an absolute sense but only in

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[2]J.C. Elsom, *Arch. Phys. Ther.*, 16:135, 1935.

[3]F.J. Gaenslen, *Ibid.*, 16:339, 1935.

[4]W.M. Northway, *Arch. Phys. Ther.*, 23:420, 1942.

[5]H. Kraus, *Arch. Phys. Ther.*, 24:151, 1943.

[6]W. Tegner, *Brit. Med. Jour.*, 2:1394, 1951.

[7]E.A. Nicoll, *Brit. Med. Jour.*, 1:747, 1943.

[8]W.B. Snow and A.D. Gurewitsch, *Arch. Phys. Ther.*, 23:69, 1942.

[9]T.L. Delorme, *Jour. Bone & Joint Surg.*, 27:645, 1945.

[10]C. MacKenzie, *The Action of Muscles*, H.K. Lewis, London, 1931.

[11]T. L. DeLorme, *op. cit.*

[12]T.L. DeLorme and A.L. Watkins, *Arch. Phys. Med.*, 29:263, 1948.

relation to the work of which the muscle was capable. For very weak muscles load-assisted exercises were recommended, using the 10 repetitition minimum—i.e. the minimum load required to assist the muscle to complete the range of movement ten times.

The drawback of DeLorme's technique is that it is time-consuming, and therefore not suitable for use with large numbers in busy departments.

Zinovieff[13] recommended a modified DeLorme technique. He found that his patients, fatigued by lifting half and three-quarters of the 10 R.M., were unable to make ten repetitions with the 10 R.M. He therefore suggested that the sequence be reversed and the load gradually decreased—i.e. the first set with the 10 R.M. followed by the second set with ¾ x 10 R.M. and the third with ½ x 10 R.M. In this way the effort required parallels the capabilities of the muscles, and the same total amount of work as in DeLorme's routine is carried out.

In both DeLorme's and Zinovieff's techniques the muscles are required to do heavy work but are not exercised to complete exhaustion. Similarly, Hellebrandt and her colleagues[14] recommend short bouts of intensive exercise, which produce only incomplete fatigue, for the development of muscle strength. They suggest 10 to 20 sets, each consisting of 25 to 40 contractions, with one-minute rest pauses between sets. Each set is carried out with the same load, the load being chosen to produce an arbitrarily selected degree of fatigue (fatigue being measured by the decrease in work done). The load is increased as soon as it produces less than the selected degree of fatigue. These workers state that speed, rhythm and load may be varied to elicit the desired physiological effect; for example, exercise with a light load is useful for mobilizing joints, stimulating the circulation, and augmenting work tolerance (i.e. endurance).

Russell[15] supports the idea that intensive exercise is not harmful. With poliomyelitis patients he introduced such exercise for five minutes once an hour for ten hours a day. Resistance was provided with either weights or springs, repeated contractions being carried out. The timing of this exercise schedule differs from the others mentioned. Kraus[16] states that timing is important, and that the result of exercising for one hour once daily differs from that obtained by five minutes exercise twelve times a day. However, he gives no further details.

MacQueen's Method

MacQueen[17] considers that a much more strenuous weight-lifting routine than that suggested by DeLorme can be used with advantage on weakened muscles. His recommendations are based on the training programmes used by professional weight-lifters and involve working the muscle to exhaustion. A suggested regimen is as follows: One set of ten lifts with the 10 R.M. followed by sets of the maximum possible number of lifts with gradually increasing loads, until the 1 R.M. is reached. This is followed by several attempts to lift a weight greater than the 1 R.M., and when this is eventually achieved a new 1 R.M. is established. MacQueen states that "the key to the development of power (strength) is decreasing the number of repetitions with increasing poundages, together with frequent attempts to increase the weights used."

MacQueen also describes a slightly less vigorous routine for developing muscle size rather than strength (though an increase in strength does result). An average routine followed by "body builders" comprises four sets of lifts with the 10 R.M. on three days a week only. He emphasizes the importance of concentration of the will on producing extreme contraction of a muscle while it is working against a great and increasing resistance.

Contrary to the other workers mentioned, MacQueen advocates "cheating" when lifting heavy weights. He states that the cheating method, which enables a greater weight to be handled, although recruiting the contraction of neighboring muscles, may make a greater demand on the particular muscle being developed than the normal method. This is reminiscent of the "mass movement" facilitation principle of Kabat.

Kabat's Method

Kabat[18] made a number of studies on neuromuscular dysfunction, and his papers stress the theoretical approach to the problem of the restoration of motor function. The rationale for the exercise regimen he recommends is as follows: When a motor unit responds to a stimulus the response is maximal (all-or-none law), and a low-resistance exercise produces a maximal response in some motor units (and always the same "low threshold" units) and none in others. Since he considered that it is motor-unit activity which results in therapeutic benefit, the aim should be to excite all available motor units in voluntary effort. This is done by means of central facilitation—i.e. increasing the level of centeral excitation so that more anterior horn cells fire off. Kabat suggested that central facilitation could be brought about in several ways, which could be used separately or together. The

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[13]A.N. Zinovieff, *Brit. Jour. Phys. Med.*, 14:129, 1951.
[14]F. A. Hellebrandt, H. V. Skowlund and L.E.A. Kelso, *Arch. Phys. Med.*, 29:21, 1948.
[15]W. R. Russell, *Poliomyelitis*, 2nd Ed., Edward Arnold, London, 1956.
[16]H. Kraus, *op. cit.*
[17]I. J. MacQueen, *Brit. Med. Jour.*, 2:1193, 1954.
[18]H. Kabat, *Arch. Phys. Med.*, 33:521, 1952.

first mechanism is the use of maximal resistance. A large proportion of available motor units are brought in to contract against this, the level of excitation being raised by proprioceptive facilitation (see later). This factor is also concerned in the second mechanism, which is that of muscle stretch. A combination of stretch and maximal resistance produces greater facilitation than either alone.

The third suggestion is that exercises should be by "mass movement" patterns, and not by the activity of isolated muscles. In this way Kabat claims that normal activity is stimulated and facilitation is by the overflow of excitation from active areas. Using this technique, muscular contraction has been demonstrated in apparently paralyzed muscles, contraction which could not be elicited in any other way. The "overflow" facilitation mechanism also operates if a reflex response is used to reinforce a voluntary one. The final facilitation mechanism Kabat calls "reversal of antagonists." If a muscle contraction is immediately preceded by a contraction of the antagonists the resulting contraction is greater than it would otherwise have been. This employs the movement which is used subconsciously in kicking, for example, or chopping wood. Kabat claims good results from the practice of these principles of exercise, but gives no quantitative details in support of his claim.

Guthrie Smith's Exercises

The exercise techniques so far described seem to be more suitable in cases where relatively few movements are affected and where the weakness is not very severe.

Active voluntary exercises suitable for very weak muscles following recent injuries and paralysis have been devised by Guthrie Smith.[19] Like other workers, she emphasized the importance of natural voluntary movements and recommended gradual progression from assisted to free to resisted movements. With the use of slings and springs a system was devised whereby the body, or any part of it, can be suspended so that it is completely relaxed. In this way all the effort can be directed towards the muscle in question, and since the movements are made under the patient's control, the maximum amount of movement without pain can be achieved. Using suitably arranged springs and pulleys, single muscles or muscle groups can be isolated, the balance between prime movers and antagonists maintained, and bilateral exercises for unequally affected muscles given. Graded springs and weight-and-pulley systems provide the necessary assistance or resistance to movement. Kraus[20] pointed out a disadvantage of using springs for resistance—that there is an increase in resistance at the stage where the muscle is least able to overcome it. He also stated that in using pulleys the alternation of movements between the healthy and injured extremities is helpful, for the injured side can learn from the uninjured. Guthrie Smith also stressed the importance of making rhythmic contractions—i.e. alternating work and rest—and of avoiding fatigue. More recent work, already described, indicates that a certain amount of fatigue is not harmful to weak muscles, and Guthrie Smith's system can be, and often is, modified for heavy work.

The Problem of Fatigue

The whole problem of fatigue in therapeutic exercise requires investigation. Before the introduction of progressive resistance exercise[21] many workers stressed the importance of avoiding fatigue.[22,23,24,25] The general trend today seems to be to use heavier and more fatiguing exercises, but the optimum level of fatigue has not been calculated. There is still a difference of opinion concerning the use of fatiguing exercises in the early stages following acute poliomyelitis, some workers having found deterioration in muscle strength after over-strenuous exercise.

Experimental Investigations

Apart from the knowledge derived from the clinical use of various exercise routines, several experimental investigators have recently been carried out specifically to study the problems of muscle training. This was made possible by the development of reliable tests of measurement of muscle strength and endurance. Using normal subjects, Baer *et al*[26] studied the effect of various exercise programmes on isometric tension, work capacity and reaction time. Darcus and Salter[27] and Salter[28] carried out similar investigations, measuring only changes in muscle strength. In all cases the exercise session was carried out once a day for four or five days a week for four to six weeks. Baer *et al* compared isotonic contractions with two different weights, isometric contractions, and a complex movement, his subjects making ten contractions only, at a rate of either 10 or 30 per minute. They found the greatest improvement in subjects exercising with a high resistance (either isometric or isotonic) at ten contractions a minute. The other workers com-

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[19]O. F. Guthrie Smith, *Rehabilitation, Re-Education and Remedial Exercise*, 2nd Ed. Bailliere, Tindall & Cox, London, 1949.

[20]H. Kraus, *op. cit.*

[21]T. L. DeLorme, *op. cit.*

[22]J. C. Elsom, *op. cit.*

[23]F. J. Gaenslen, *op. cit.*

[24]J. Mennell, *Brit. Jour. Phys. Med.*, 5:40, 1942.

[25]W. B. Snow and A. D. Gurewitsch, *op. cit.*

[26]A. D. Baer, J. W. Gersten, B. H. Robertson, and H. Dinken, *Arch. Phys. Med.*, 36:495, 1955.

[27]H. D. Darcus and N. Salter, *Jour. Physiol.*, 129:325, 1955.

[28]N. Salter, *Jour. Physiol.* 130:109, 1955.

pared 30 isometric with 30 isotonic contractions, made at a rate of one, two or fifteen per minute. No significant difference was demonstrated between these six routines. Further work is in progress in an attempt to determine the optimum values for the different variables.

It is of considerable clinical importance to know if exercise in one position of the joint only is as efficient as in any other, or as isotonic contractions, and if fatigue is an important factor. The restoration of function of the quadriceps in a flexion contracture of the knee due to rheumatoid arthritis is an obvious example.

Several investigators in recent years have demonstrated the phenomenon of cross-education in experimental subjects.[29,30] They have shown that exercise of one side of the body results in an increase in strength of the corresponding muscle group on the other side. Hellebrandt and Houtz[31] have also shown that simultaneous exercise of both sides increases the work capacity of the weaker side. It is possible that these findings might be of value in therapeutic exercise.

Care must be taken in applying the results of experiments on normal muscles to remedial exercises for diseased muscles. Furthermore, there is evidence to suggest that the problem of wasted muscles in diseases mainly affecting joints—e.g. rheumatoid arthritis—is different from that of weak muscles around normal joints. Electrodiagnostic investigations in rheumatoid arthritis have shown that there are disorders of neuromuscular function in the affected muscles, and it may well be that the correct exercises to restore function in these muscles differ from those prescribed for weak muscles following fractures, etc. Clearly it is not wise to assume that the techniques will necessarily be the same.

As well as providing the basis for the exercise programmes of DeLorme and MacQueen, the principles of the intensive and progressive exercise used by weight-lifters have been tried out in the field of physical education. Adamson[32] compared this type of exercise with the normal school physical education programme, and demonstrated its superiority in augmenting muscular strength, power, and endurance and circulo-respiratory endurance. The "circuit" training he used[33] involved one 30-minute period per week, using some gymnastic apparatus. The subject performed a series of pre-arranged exercises at one-third of his maximum ability (e.g. one-third the maximum number of press-ups), the dosage being increased when he could lap the circuit three times in half an hour.

Physiological Basis of Exercise Therapy

Most workers agree that systematic active exercise is essential for functional recovery following injuries or diseases of the neuromuscular system. Irrespective of the type of exercise carried out, repeated activity of muscles results in the acquisition of skill and ease of muscle action and the development of precision and co-ordination. Watkins[34] has stated that the greatest single factor in improvement in muscle performance is learning; the patient's concept of effort changes, as does his willingness to exert himself despite discomfort. Improvements occurring should be interpreted with care for this reason. Two factors which are important in this connection for anyone prescribing or supervising exercise are: (1) it is essential to retain the active and intelligent co-operation of the patient during the exercise period; and (2) the exercise routine should be as variable as possible in order to prevent boredom.

Muscle action results in a temporary improvement in muscle blood supply. Repeated activity may result in the opening up of new capillary channels. Heavy exercise results in the co-ordinated development of the circulatory, respiratory and nervous systems. Apart from these general effects of exercise, it has been stated that systematic voluntary exercise facilitates the transmission of nerve impulses across the motor end-plates. It is claimed that this would lead to a more complete use of available muscle fibres.[35] It is difficult to prove this.

It is known that weak muscles often respond to therapeutic exercise by hypertrophy. This increase in muscle bulk is not necessarily proportional to the increase in strength, for we have found that, following rehabilitation after meniscectomy, quadriceps function may be equivalent to that on the normal side although there is up to one inch of wasting. The actual site of the hypertrophy is uncertain. It has been shown in experimental animals that no new muscle fibres are formed, but that an increase in size of existing fibres and an increase in the formation of new capillaries may occur.[36]

It is generally agreed that movement through the maximum possible range without pain is most bene-

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[29]F. A. Hellebrandt, A. M. Parish and S. J. Houtz, *Arch. Phys. Med.*, 28:76, 1947.
[30]H. D. Darcus and N. Salter, *op. cit.*
[31]F. A. Hellebrandt and S. J. Houtz, *Jrnl. of Applied Physiol.*, 2:446, 1950.
[32]G. T. Adamson, *J. Phys. Educ.*, 45:22,1953.
[33]G. T. Adamson and R. E. Morgan, *Ibid.*, 46:1, 1954.
[34]A. L. Watkins, *New Engl. J. Med.*, 238:631, 1948.
[35]E. C. Elkins and K. G. Wakim, *Arch. Phys. Med.*, 28:555, 1947.
[36]T. Petren, T. Sjostrand and B. Sylven, *Arbeitsphysiologie*, 9:376, 1936.

ficial[37,38,39,40] partly because of the increase in blood and lymph flow which it produces. Isometric contractions—e.g. quadriceps setting—are valuable when joint movement is contraindicated, and experimental work has shown that, providing a high resistance to contraction is given, isometric exertions can be as beneficial as isotonic. Mennell[41] advocated movement through only the inner range while a muscle is very weak.

Most present-day workers agree that, in order to develop muscle strength as rapidly as possible, muscles should be exercised in the "overload" zone—i.e. the amount of work performed should exceed that normally performed with ease.[42,43,44,45] The mechanism by which resistance increases the power of muscular contraction and the proportion of active motor units is apparently related to the tension in the muscle. When the muscle contracts against a strong resistance the tension in the muscle is increased, and a proprioceptive stimulation resulting from this facilitates the voluntary motor mechanism.

DeLorme's routine originally had a practical background rather than a theoretical basis. Introducing his technique for clinical purposes, DeLorme stated that the marked response in muscle hypertrophy and power with symptomatic relief seemed to contraindicate any possible violation of physiological principles. He also stated that competent physiologists who had seen the exercise being performed "felt fairly certain that the fatigue was at the neuromuscular junction and not of the muscle fibre." The degree to which muscles should be exercised in the overload zone has not yet been determined—i.e. whether or not it is necessary or desirable to exercise to exhaustion.

DeLorme has stated that in order to produce maximum hypertrophy and increase in muscle strength the heaviest load should be imposed on the muscle as it approached complete contraction. MacQueen confirms this and states that the principle has long been known by weight-lifters to produce rapid gains in size and strength. This is presumable because more muscle fibres are required to deal with a given load when the fibres are short (and the contractile force therefore low) than at the beginning of the contraction.

Kabat demonstrated a high degree of facilitation when a muscle was stretched prior to contraction. This may be explained by the servo-mechanism which controls muscular movement. The sensory receptors in the muscle, the muscle spindles, are in parallel with the muscle fibres and signal information to the spinal cord concerning differences in length between the main and the intrafusal fibres. In the maintenance of normal posture, a lengthening of the muscle increases this difference and excites the stretch reflex, through which the muscle returns to its normal length. This self-regulatory mechanism is known as a servo loop.

Recent work on the muscle spindles has shown that the intrafusal fibres are innervated by small motor nerve fibres. During postural contraction, tonic impulses passing down these nerve fibres maintain constant the length of the intrafusal fibres and thus the length of the whole muscle. Muscle shortening involves increased excitation and shortening of the intrafusal fibres, which increases the difference between the main and the intrafusal fibres and thus leads to muscle shortening by servo action. The effect of stretching the muscle prior to contraction is to increase still further the difference between the main and the intrafusal fibres, and thus produce a stronger contraction.[46]

Summary

It is difficult to assess critically the present position regarding exercise therapy, as few quantitative results are given in the literature, and where details are given, different criteria of improvement have been taken. Good results have been obtained in a variety of conditions when the DeLorme principle has been used, but it is impossible to compare these with any similar results from the use, for example, of MacQueen's technique.

During the last ten years the tendency seems to have been toward heavier exercise with less emphasis on avoiding fatigue, and it would appear that the most important factor to determine is the extent to which overload exercise is necessary and desirable in different conditions.

The following summary groups together those exercise programmes which are based on the same or similar principles.

I. *Simple exercise without the use of apparatus*

(a) Isometric contractions—e.g. quadriceps setting.

(b) Isotonic contractions with progression from gravity-assisted to free to gravity-resisted exertions.

(c) Kabat's technique, employing maximal resistance and facilitation principles to reinforce muscular contractions.

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[37] J. C. Elsom, *op. cit.*
[38] W. M. Northway, *op. cit.*
[39] C. O. Molander and B. Weinmann, *Arch. Phys. Therapy*, 24:74, 1943.
[40] N. S. Ransahoff, *J. Bone Jt. Surg.*, 26:99, 1944.
[41] J. Mennell, *op. cit.*
[42] T. L. DeLorme and A. L. Watkins, *op. cit.*
[43] S. Mead, *J. Amer. Med. Assoc.*, 144:458, 1950.
[44] H. Kabat, *op. cit.*
[45] I. J. MacQueen, *op. cit.*
[46] P. A. Merton, *Servo Control of Movement*, Churchill, London, pp. 247-260, 1953.

THE EFFECTS OF EXERCISE ON THE REDUCTION OF BODY WEIGHT

JOAN EVANS, M.S.*

LEO ELLISON, M.S.**

EDWARD K. CAPEN, Ph.D.***

The effect of exercise upon weight reduction has long been a controversial issue among authorities in the areas of physical education, physiology, and medicine. One group contends that: "Exercise is not a practical way to take off fat . . . Consuming fewer calories is the one sure way to melt fat and lose weight."[1] Among the group taking direct issue with those who say exercise is of no value because it doesn't use up many calories are Drs. Jean Mayer and Frederick J. Stare of Howard School of Public Health. These research workers point out that "a person who walks at a fairly fast rate for thirty minutes, for example, can use up 550 calories, or the equivalent of a piece of apple pie a la mode."[2]

Certain followers of the first line of thought point out the strenuous tasks necessary to lose one pound of fat: "Play Ping Pong for 17¼ hours . . . Fox trot 16 hours . . . Do 5,714 push-ups from the floor."[3] Mayer points out, however, that:

> The enemies of exercise visualize any given wearying performance as being accomplished in a single uninterrupted stretch. The energy expenditure accompanying physical activity takes place, however, whether the activity is performed in a day or decade. Splitting wood for seven consecutive hours would be difficult for anyone . . . but splitting wood for half an hour a day—in no way an impossible assignment for a healthy man—will add up to the desired seven hours in a fortnight.

Mayer then points out that if these thirty minute "lumbering operations" become a regular practice, it would be "calorically equivalant to twenty-six pounds of body fat a year."[4]

The physiology laboratory has been one source of research to determine the effects of various types of exercise upon weight loss.[5] This physiological approach has been based upon the amount of increase in the basal metabolic rate as a result of various types of exercise, and the findings have generally stated that exercise will aid very little in weight reduction.

It was the purpose of this research to further study the effects of exercise on weight reduction by experimentation with a group of overweight subjects participating in a conditioning program and maintaining a normal diet of food.

Review of Related Literature

The number of articles in newspapers and magazines featuring a variety of weight reduction programs testifies to the magnitude of the problem of weight control and the general interest in it.

Evidence which suggested that overweight is becoming more frequent in white men and less frequent in white women was presented by the use of charts and tables. It is also pointed out that obesity is associated with definite health hazards in terms of an increased incidence of many serious diseases and impaired life expectancy.[7]

Aaron[8] wrote an article on weight control by using his own experience and by studying insurance bulletins and research by other medical men. He found through his readings that the most popular reducing exercise among obese people was massage. He further states that most of the calories expended come from the activity of the masseur and not of the patient. According to Aaron, fatty tissue cannot be displaced or made to disappear by any physical or chemical method within the resources of a slenderizing salon.

George[9] explains in detail the relation between metabolism, calories, and energy. In his book he attemps to remove the belief that glandular disturbances are a common cause of corpulence, or that drugs, massage or exercise can control it. George bases his statements and ideas on his own experience with overweight patients. He believes that diet is the best way to lose weight.

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*Instructor of Physical Education for Women, Northwestern State College, Natchitoches, Louisiana.

**Instructor of Physical Education for Men, Wake Forest College, Winston-Salem, North Carolina.

***Associate Professor of Physical Education, The University of Tennessee, Knoxville, Tennessee.

[1] "Exercise Can Check Obesity," *Science Digest* 34:50, Nov. 1953.

[2] *Ibid.*

[3] Arthur H. Steinhaus, Alma M. Hawkins, Charles D. Giauque and Edward C. Thomas, *How to Keep Fit and Like It*, Consolidated Book Publishers, 1943.

[4] Jean Mayer, "Exercise Does Keep The Weight Down," *The Atlantic Monthly*, 196:63-66, July 1955.

[5] *Ibid.*

[6] Peter V. Karpovich, *Physiology of Muscular Activity*, 4th Edit., W. B. Saunders, 1955.

[7] Ercel S. Eppright, Pearl Swanson and Carrold A. Ivarson, *Weight Control*, Iowa State College Press, 1951.

[8] Harold Aaron, "Weight Control," *Consumer Reports* 17:100-106, Feb. 1952.

[9] Alfred L. George, *Your Weight and Your Life*, W. W. Norton Co., 1951.

In the book "Weight Control," it is pointed out that splitting wood for seven consecutive hours would be practically impossible for the average person.[10] To spread this activity over a period of two weeks at the rate of thirty minutes per day by no means would make it an impossible feat. The author is convinced that inactivity is the most important factor explaining the frequency of creeping overweight in our society. In order to combat this, a person will have to diet or increase his physical activities through sports and hobbies. In a later publication Mayer[11] stated his belief of the inadequacy of team sports for post school years. He believes one should develop skills in individual and dual sports that can be enjoyed throughout life.

A reasearch study was done in the physiology laboratory by Weiss and Karpovich.[12] They prepared a cost list of forty-two different exercises which may be used for prescription of any desired dosage of calisthenics. The cost of an exercise was expressed as a ratio of the work metabolism rate to the resting metabolism rate.

Duncan[13] presents empirical evidence that exercise along with a diet will cause weight reduction, giving the example of a golfer who played eighteen or more holes of golf every day while dieting. The golfer lost fifty-two and one-fourth pounds within a period of eleven weeks. He believes that the removal of this weight would have taken much longer without the exercise.

Hauser[14], without showing any scientific evidence, states that exercise will not reduce the overweight person but that it will help restore the body proportions. He further states that exercise will help take up the slack in loose skin while dieting.

Heller[15] states that 90 per cent of all cases of obesity are due to overeating. The other 10 per cent are innocent because some travel by automobile in place of walking and some have glandular disorders. She points out that fatness may run in the family but that it is possible to keep this tendency away.

Mayer and Frederick, as reported by Snider[16], point out that farm workers at the peak of the harvest season have been repeatedly observed to have lost weight in spite of heavy eating. They also made similar observations of soldiers under strenuous field conditions. Many of these soldiers gained weight after being discharged.

After studying data collected on food intake and body size of Iowa children, Eppright, Sidwell, and Jebe[17] showed that chances for a trim waist-line were best among the girls who ate nutritionally adequate diets.

Blakeslee[18] reported a study conducted by Mayer, Burke and Johnson which pointed out that even though the normal weight girls ate more than the overweight girls, they were more active in sports and recreation. This study included high school girls, of which twenty-eight were overweight.

As reported by Eppright in the chapter, "Body Composition and Its Change With Age and Diet," Keys stated:

> **The person who is really obese tends preferentially to lose fat on a low-calorie diet but even so a considerable portion of his weight loss is water and cellular matter. If dieting is combined with an increased exercise program, there is a gain of muscle mass so that merely watching the total weight underestimates the reduction in body fat.[19]**

Procedure

The procedure including the subjects, the measurements, and the conditioning programs are described below.

13 overweight college freshmen men and 22 overweight college freshmen women were used in this study. The extent of obesity was determined by the use of the McCloy Technique for prediction of normal weight.[20] The measurements used were height, chest girth, hip width, and knee width. Chest girth and hip width were corrected for deficiencies or excess of fat. These corrections were based upon measurements of skin and subcutaneous tissue taken with fat calipers. A normal weight was predicted for each subject. The difference between predicted normal weight and the present weight was computed.

Before and at the conclusion of the exercise program, the following measurements were determined:

Women

Medical Examination
Right and left hand grip strength[21]
Leg lift strength[21]
Back lift strength[21]
Pulling strength[21]
Pushing strength[21]

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[10]Ercel S. Eppright *et. al., op. cit.*

[11]Jean Mayer, "Exercise Can Keep Us Fit," *Journal of Health, Physical Education and Recreation,* 27, Sept. 1956.

[12]Peter V. Karpovich, *op. cit.*

[13]Garfield G. Duncan, Editor, *Diseases of Metabolism,* W. B. Saunders Co., 1952., xviii.

[14]Gayelord Hauser, *Intelligent Reducing,* Stratford Press, 1955.

[15]Ann Williams Heller, *It's A Sin to Be Fat When You Don't Have To Be,* Graystone Press, 1948.

[16]"Exercise Can Check Obesity," *op. cit.*

[17]Jean Mayer, "Exercise Does Keep The Weight Down," *The Atlantic Monthly,* 196:63-66, July 1955.

[18]Alton L. Blakeslee, "Exercise and Slimness," *Today's Health* 34:17, July 1956.

[19]Ercel S. Eppright *et al., op. cit.*

[20]C. H. McCloy, *Appraising Physical Status: Methods and Norms,* University of Iowa Press, 1938.

[21]C. H. McCloy, *Tests and Measurements in Health and Physical Education,* Appleton-Century-Crofts, 1954.

Mean Improvement in Weight Loss and Gain in Muscular Strength and Power†

Test	Initial†† Mean	Final Mean	Mean Difference	t	% Level of Confidence
Weight	208.02	201.90	—6.3	4.20	.12
Right Grip	130.38	135.76	5.38	3.22	.76
Left Grip	118.23	121.46	3.23	2.54	2.80
Back Lift	352.69	411.07	58.38	4.76	.04
Leg Lift	1188.84	1293.08	104.24	3.84	.26
Pull-Up	2.38	3.94	1.56	4.22	.12
Dips	1.30	6.97	5.67	5.87	.00
Sargent Jump	50.00	53.00	3.0	4.92	.04

†N = 13

††The initial and final recordings in this table are the means for the thirteen subjects. Weight was recorded in pounds as measured on balance scales. Right grip, left grip, back lift, and leg lift were recorded in pounds as measured on a manuometer and a back and leg dynamometer. Pull-ups and dips were recorded in number performed and Sargent jump was recorded in centimeters.

Table 1
(Men)

Mean Improvement in Weight Loss and Gain in Muscular Strength and Power†

Test	Initial†† Mean	Final Mean	Mean Difference	t	% Level of Confidence
Weight	162.2	159.6	—2.6	4.1	.05
Right Grip	71.2	73.3	2.1	1.8	8.62
Left Grip	63.0	67.3	4.3	3.2	.43
Back Lift	204.0	204.3	.3	.7	49.16
Leg Lift	475.0	546.6	71.6	3.6	.17
Pulling Strength	54.2	62.0	7.8	5.2	.00
Pushing Strength	50.2	58.3	8.1	5.8	.00
Pull-Ups	17.5	25.8	8.3	5.5	.00
Sargent Jump	32.2	34.9	2.7	2.5	2.08

†N = 22

††The initial and final recordings in this table are the means for the 22 subjects. Weight was recorded in pounds as measured on balance scales. Right grip, left grip, back lift, leg lift, pulling strength and pushing strength were recorded in pounds as measured on a manuometer and a back and leg dynamometer. Pull-ups were recorded in number performed and Sargent jump was recorded in centimeters.

Table 2
(Women)

Pull-ups[21]
Sargent jump[21]

Men
Medical Examination
Right and left hand grip strength[21]
Leg lift strength[21]
Back lift strength[21]
Dip test[21]
Pull-ups[21]
Sargent jump[21]

Weekly weight recordings were obtained throughout the experiment period.

The exercise program which was conducted five days per week for ten weeks, consisted of a warm-up period, strenuous calisthenics, weight training for the men*, rope skipping and running.

The calisthenics included sit-ups, push-ups, deep knee bends, bent knee sit-ups, four-count burpee, weidman stretch, leg lifts, and several additional variations of these exercises.

The weight training exercises included four standard exercises.

Rope skipping and running involved five minutes of each with a two or three minute period of walking after the running.

Mean Weight Loss Occurring During The Ten Weeks Experimental Period* (Men)

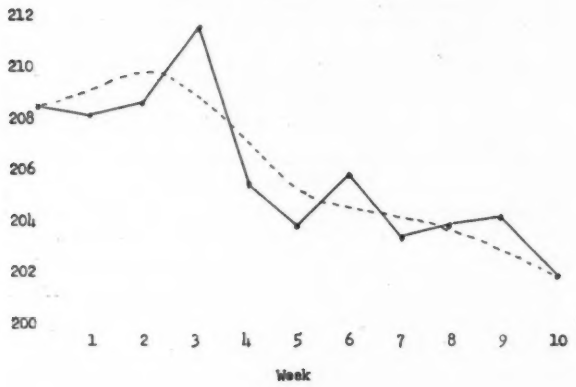

Fig. 1

*The mean weight recorded for each week is the mean weight of the thirteen subjects. The dotted line was placed on the graph to show the weight gain and loss tendency throughout the ten weeks.

Results

As shown in Table 1 and 2, both the men and women lost weight and these losses were statistically significant at the .12% and .05% level of confidence respectively. The loss in body weight was not large but was consistant.

It may also be seen in Table 1 and Table 2 that muscular strength and power were gained. These gains were for the most part statistically significant gains. The exception to this was in the back lift so far as the women were concerned. This being a rather difficult strength test to measure accurately, it is suspected that error in measurement crept in.

Mean Weight Loss Occurring During The Ten Weeks Experimental Period* (Women)

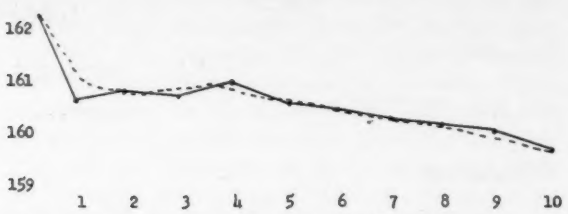

Fig. 2

*The mean weight recorded for each week is the mean weight of the twenty-two subjects. The dotted line was placed on the graph to show the weight gain and loss tendency throughout the ten weeks.

Fig. 1 and Fig. 2 present the mean body weight measured weekly throughout the experiment period. The tendency with both the men and women was to lose body weight during the first week or two, then an apparent gain in weight occurred between the third and fourth week after which a decline took place throughout the remainder of the experiment period.

Summary and Conclusions

Only a brief survey of the numerous articles written on the subject of obesity gives the reader a realization of the conflicting points of view concerning the benefits of exercise. The purpose of this research was to further study the effects of exercise on weight reduction by experimentation with a group of overweight subjects participating in a conditioning program and maintaining a normal diet.

It can be seen that a steady dosage of exercise carried over a certain period of time will result in weight reduction, providing the diet is not appreciably increased with the activity. Eppright and others[22] pointed out Mayer's idea, that splitting wood for seven hours will burn up a pound of fat and that this same activity carried over a period of two weeks will have the same results.

If additional body measurements had been taken before and after the experiment, the difference in body size might well have been significant. The increased circulation and added muscle weight probably added weight and kept fat loss from showing on the scales. This is in agreement with Key's statement

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*The term *weight training* as used in this study denotes a routine of calisthenics performed with bar bells and dumbbells.

[22]Ercel S. Eppright *et al., op. cit.*
[23]*Ibid.*

PM & R TREATMENT AIMS FOR NP HOSPITALS: A SIMPLIFICATION

RICHARD G. HANNAN, C.C.T.**

RICHARD C. COWDEN, Ph.D.*

Introduction

The patient treatment program of this hospital calls for the ward physician to prescribe the treatment aims (Table 1) to be sought by the various PM&R therapists. These treatment aims are frequently couched in the rather abstract terminology of psychoanalysis, and are based on work done some twenty years ago.[1,2]

A preliminary view of the hospital treatment program in general and of the prescribed treatment aims in specific suggest that the treatment aims as now prescribed lead to considerable confusion and misunderstanding, and as a result tend to retard the treatment program. The confusion regarding treatment aims is present in both the prescribing physician and the therapist responsible for carrying out the order. Practically all of these aims are open to as many interpretations as there are therapists. The therapist frequently does not know what the physician intends by his prescription. This study seeks to: (1) establish the fact that the present treatment aims are not understood by either the physician or the therapist, and (2) to set forth a simple, more elastic set of treatment aims which should aid the progress of the patient. At least, it might make the job of the therapist more meaningful and understandable.

Method

The present list of treatment aims was submitted to all the prescribing physicians and to all the PM&R therapists. The physicians were asked to explain briefly what is meant by each treatment aim, the reason for using it specifically, and the procedure required to carry it out. The therapists were asked to describe their interpretation of the treatment aim and the procedure to be followed to insure success. Upon receipt of these data, the experimenters reviewed the similarity of explanation and interpretation of the various treatment aims. If there was wide divergence in the data, then the experimenters attempted to group these treatment aims into simpler headings. Five psychiatrists and seventeen therapists returned the completed forms.

1. Increase self reliance
2. Strengthen ego
3. Substitute for alcoholism
4. Relieve tension
5. Test reality
6. Stimulate interest
7. Self gratification
8. Establish rapport
9. Channel anxiety symptoms . . . to diminish
10. Externalize interest . . . from phantasy world
11. Habit training for self interest and appearance
12. Command attention and concentration to synthesize disordered thought processes
13. Group interaction with acceptable socialization
14. Sublimate homosexual urges
15. Attempt to sublimate symptoms
16. Provide outlets for hostility and aggressions
17. Supply means for atonement of guilt
18. Free the expression of phantasy
19. Make opportunity for creativeness
20. Resocialization
21. Provide opportunity for socially acceptable accomplishments (narcissistic gratification)
22. Provide opportunity for acceptable expression of aggressions
23. Provide opportunity for relief of guilt feelings
24. Provide opportunity for vocational adjustment and the learning of new skills
25. Provide opportunity for development of hobby and activity interest
26. Develop a sense of social responsibility

Table I

Only one psychiatrist defined all the aims, and he stated that eleven of the twenty-six were duplications. Another used only two aims (Stimulate interest; Develop hobby and activity interest). A third psychiatrist stated that the terms meant little or nothing tc him, and he saw no specific reason for using a particular aim. The other two used some of the terms but not all, omitting an average of ten. The most significant aspect is that no one of the five clearly stated the reasons for using each one, or the procedure for carrying it out. The seventeen therapists, in general, were able to define the terms, but again there appeared an inability to state the method by which such aims could be achieved. The definitions were of a textbook variety and not applicable to individual

*Clinical Psychologist, Veterans Administration Hospital, Chillicothe, Ohio.

**Corrective Therapist, Veterans Administration Hospital, Chillicothe, Ohio.

[1]W. C. Menninger, "Psychoanalytic Principles Applied to the Treatment of Hospitalized Patients," *Bull. Menninger Clin.* 1:35-43, Nov. 1936.

[2]W. C. Menninger, "Phychiatric Hospital Therapy Designed to Meet Unconscious Needs," *Am. J. Psychiat.* 93:347-360, Sept. 1936.

cases. On practically all returns the therapists and doctors showed the ability to define the various aims in a general fashion, but were unable to give an operational or working definition. The statements gave as a solution to each aim, usually one of the following three:

1. Provide a means of expression
2. Provide a feeling of accomplishment
3. Socialization

Some therapists felt that they were not given adequate information in regard to what made the patient ill. Others, however, "know" that homosexuality is due to "physical make-up" and interpret the treatment aim dealing with homosexuality from this frame of reference. This suggests a danger in submitting open-ended, ill defined, yet very specific treatment aims to individual interpretation.

The above results give strong evidence that the current treatment aims are inadequate. It was then felt that new ones should be established. In establishing the new aims, we felt that they should meet the following requirements:

1. Treatment aims should be patient oriented.
2. They should be flexible enough to allow progression as the patient improves.
3. They should be general, rather than aimed at one specific sympton. (Schizophrenics have syndromes, not *a* symptom.
4. They should be within the training and understanding of available personnel.
5. They should meet the requirement of economy; that is, they should be such that the prescribing physician can accurately determine the aim after a brief interview and adequately communicate this aim to the therapist.

With these requirements in mind, and also remembering the three solutions recommended by the therapists (Provide a means of expression, provide a feeling of accomplishment, and socialization) we established the four new treatment aims shown in Table II (below).

1. Stimulate and encourage the patient to sustain a simple activity of his own choosing for a length of time.
2. Enable a patient to participate in a more complex activity with minimal threat of failure.
3. Enable a patient to interact socially and physically with the therapist.
4. Enable and encourage a patient to interact socially and physically with other patients.

A list of the twenty-six current treatment aims was submitted to thirty therapists and eight psychiatrists at this hospital. They were asked to place each of the current aims (Table I) under one of four suggested new treatment aims (Table II). They were told that these aims could be placed in more than one of the four new categories if they felt that they belonged. Specifically, they were asked which of the old treatment aims would be satisfied by which of the four new suggested treatment aims. Of the eight psychiatrists, seven responded. Six educational therapists responded out of six submitted. 13 corrective therapists responded out of 13 submitted, while only two occupational therapists responded out of 11 submitted. The total *N* was twenty-one for the therapists, seven for the psychiatrists. The method of analysis was to make a count of the number of times each current aim is placed under one of the new suggested aims. Chi-square and the binominal expansion were used as statistics.

Results

The seven psychiatrists agreed significantly (*P* less than .05) that *nine* of the old treatment aims could be satisfied by *one* of the four new treatment aims. To reach a *P* of less than .05, six of the seven had to agree. Of these nine, six were satisfied by new aims I and II, those dealing primarily with keeping the patient busy and happy. Aim III, Interaction with the therapist, satisfied only old treatment No. 8 which was "To establish rapport." Aim IV satisfied only original aims No. 13 and No. 26 which dealt with learning to socialize.

These results suggest the psychiatrists perceive these therapies as a means of merely keeping the patient busy and happy with the therapist himself achieving only one thing, and that is to establish rapport. The therapists are not perceived as therapeutic agents *per se*, rather the tasks are the important things.

The twenty-one therapists agreed significantly (P less than .05) that ten of the old treatment aims were satisfied by one of the four new treatment aims. Of these ten, six were satisfied by Aims I and II, four by Aim III, Interaction with the therapist, and Aim IV, Interaction with other patients. These results suggested that the therapists tend to look upon themselves as therapeutic agents, as well as the task involved. However, even here, the therapist perceives himself as primarily stimulating interest, establishing rapport or aiding in resocialization. Supportive evidence for this was found in the data dealing with the total number of old aims placed under one of the new categories. The therapists picked category III as the most effective way to handle the twenty-six symptoms in the old treatment aims. The category III deals with interaction with therapist socially and physically. The seven psychiatrists picked category II, "Participate in a more complex activity with minimal threat of failure," as the most important category.

These results suggest that neither the therapist nor the psychiatrist agree, at a significant level, on

how to handle all of the twenty-six old treatment aims. The agreement was 50% or better an all but seven of the treatment aims. Of these seven, two were duplications, so actually there were only five treatment aims on which there was not, at least, 50% agreement as to which of the new categories they should fit. The specific old treatment aims that neither the therapists nor the physicians could agree on were No. 3, "Substitute for Alcoholism;" No. 11, "Habit Training for Self Interest and Appearance;" No. 12, "Sublimation of Homosexual Urges"; Nos. 16 and 22, dealing with expression of aggressions; and Nos. 17 and 23, dealing with handling of guilt feelings. On all the other treatment aims there was at least 50% agreement as to the category into which the old treatment aim should fit.

When one considers the original data reported above in conjunction with this second part of the study, it is obvious that the original treatment aims are inadequate. They are not used; and when they are used, they appear not to be understood. The prescribing physicians do not interpret the treatment aims as do the therapists. The four new treatment aims suggested apparently do not handle two very important items. They were not agreed upon in the most recent rating. These are (1) a means of handling hostility and aggression, and (2) a means of handling guilt feelings. Whether this inability to agree on these two items is a function of the scale or a function of the raters cannot be determined on the basis of this data. These are symptoms which have always been a source of disagreement as to the best means of coping with them.

Another item of interest which came out of this second part is the relative comfort the different therapies have in dealing with various symptoms. That is, of course, if you consider the original 26 treatment aims as primarily a listing of symptoms. The data suggests that the corrective therapist feel more capable of dealing with patients who are so sick as to require new treatment aims I and II, and as the patient progresses to stages III and IV the educational therapists begin to feel they are more able to make a contribution. This is understandable in the light of the various techniques used by the different therapies and suggests that perhaps the hospital is making an error by randomly, or rather rigidly, assigning patients to all therapies. There is a definite suggestion that when the patients are sick enough to require new treatment aims I or II, they are too sick to benefit materially from what educational therapy has to offer them. When the patients get to stages III and IV they are able to deal with and benefit from educational therapy material. At the same time the need for what corrective therapy has to offer diminishes. The fact that only two occupational therapists returned their questionnaires prevents any attempt to make suggestion about their role in the hospital treatment program.

In summary, the data on the two parts of this study strongly suggests that the current treatment aims need to be replaced. They appear to be ineffective in conveying information from the psychiatrist to the therapist; they are not interpreted the same and they are not put into effect in a manner agreeable to both groups. The suggested new treatment aims, although not able to satisfy all of the current treatment aims, seem to be an acceptable replacement. They have in their favor the fact that they meet the practical requirements of the hospital in that they enable the hospital to keep patients off the wards, categorize the patients in such a manner that the psychiatrist and the therapist both interpret the patient's action in the same manner, and, as a result, enhance communication between the two groups. They appear practical, simple and are primarily first level abstractions in that they are concrete behavioral events. They do not involve any technical language which would be open to different interpretations nor do they require an exceptional amount of skill on the part of the therapist. It should be stated that the data collected during this research is not conclusive, but merely indicates the trend or tendencies and strongly suggests that further research be done in this area. The data is quite conclusive in one thing, however—that current treatment aims should be replaced.

Discussion

The four new treatment aims are suggested as a replacement for the current ones, and they meet the requirements previously outlined. They are patient oriented in the respect that they are individually oriented. In other words, they are rather concrete steps which follow through and should carry a patient from the time he enters the hospital to the time he is discharged. For example, a mute, withdrawn apathetic schizophrenic, upon admission to the hospital and after intake interview would probably be assigned to Stage I of these treatment aims which is to enable and encourage the patient to sustain an activity of his choosing for a length of time. As the patient progressed in the direction of becoming more healthy, the therapist would then try to engage the patient in more difficult activity, but, at the same time, assuring minimal threat of failure. As the patient continues to build up his own feelings of self-adequacy and self-acceptance, the therapist would then inform the psychiatrist of this fact, simply stating that the patient has passed beyond Stage I to Stage II and might be ready

for Stage III. At this point, the psychiatrist could see the patient for a short interview and determine whether the therapist is correct or not. If he is, he could recommend that the therapist then start working on Stage III. When the patient gets into Stage III or Stage IV, he is probably ready to leave the hospital. The psychiatrist would become cognizant of this fact when he reads the routine report submitted by the therapist.

These aims are general in that they are not aimed at one specific symptom. They are based on the idea that most of these patients have lost a great deal of self-respect and confidence and feel quite inadequate at all tasks. These four stages meet the requirements of just about any schizophrenic patient. They are within the level of training and understanding of the available personnel. They do not have any psychoanalytic terms nor concepts in them. They are rather simple behavioral events which are easily observed and readily recorded. Reports could simply state at what stage a person is performing, how he is doing this, and the therapists's judgment as to whether he is ready to move on to the next step. They meet the requirement of economy, as it would take only a very brief interview for the psychiatrist to determine at what stage the patient is functioning. And routine ward rounds would disclose whether the patient is ready to move on to a different level of activity, whereas, it would probably be quite difficult to make a clinical judgment as to whether narcissistic needs have been gratified or homosexual urges sublimated, etc. These new aims should enhance communication between the psychiatrist and the therapist.

EXERCISE THERAPY—Cont'd from P. 55

II. *Exercises using springs, weights, and pulleys to provide resistance to muscle contraction*

(a) Guthrie Smith technique, particularly suitable for very weak muscles.

(b) Russell's intensive exercise regimen for poliomyelitis cases.

(c) Exercises for building strength based on the progressive high resistance-low repetition principle.

1. DeLorme: This routine is carefully described, the patient using weights up to and including the 10 R.M. This schedule has been shown to be beneficial in a variety of abnormal conditions and is widely practiced.
2. Zinovieff: This is a modification of DeLorme's exercise programme, but there is no evidence to show that it is an improvement.
3. Hellebrandt: This is also very similar to DeLorme's technique, but not as clearly defined. The routine allows for modification for building endurance—e.g. low resistance—high repetition exercise.
4. MacQueen: This schedule is based on the type of weight training programme used for normal muscles, the patient using weights exceeding the 10 R.M. There is no evidence to show that this is necessarily suitable for weak muscles.

No work has been found recording any comparison between these different methods of exercise.

Improvements in exercise technique continue, with information gained from the practice of different routines in different spheres and from experimental work. The link between weight training methods, therapeutic exercise, and physical education has been demonstrated.

Much progress has indeed been made since 1581, when Richard Mulcaster wrote: "There be six circumstances, which leade and direct all exercises and are carefully to be considered of by the trayning maister: the nature of the exercise ye intend to use, the person and the body which is to be exercised, the place wherein, the time when, the quantitie how much and the maner how." (Armytage, 1953).

It seems possible that with oportunities for further experimental investigations and for the study of clinical routines in practice, the outstanding problems in exercise therapy may be answered.

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VA TO TEST NEW ANTI-TB DRUG

A new synthetic drug, thiocarbanidin, will be tested against tuberculosis by Veterans Administration, the agency has announced. The study will be part of VA's continuing project for clinical trial of newer TB drugs in cooperation with the Armed Forces, which has produced findings leading to present use of TB therapies by the entire medical profession.

VA said use of thiocarbanidin in humans and in animals, reported by guest speakers at VA's recent annual TB meeting, indicates the drug has no ill effects and may be helpful to patients for whom treatment with other TB drugs is not satisfactory. VA doctors hope the new compound may prove to be an acceptable substitute for PAS, one of the widely used TB drugs. PAS causes nausea and vomiting in some patients, and some have developed resistance to this drug so that it is no longer useful against their infections.

Thiocarbanidin is given by mouth in small doses, and its therapeutic effect is reported to be similar to that of PAS, VA said.

The new drug will be given to VA patients in combination with streptomycin or isoniazid. The agency is developing plans as to which hospitals will use thiocarbanidin, how long the study will be, and the number and type of patients to be selected.

REDUCTION—Con't from P. 59

as pointed out by Eppright, " . . . there is a gain of muscle mass so that merely watching the total weight underestimates the reduction in body fat[28].

Most of the subjects stated that they felt as if they had lost more weight than the scales showed, because their clothes fitted better than before. This apparent greater decrease in body size is also suggested by the posture pictures which showed slightly improved appearance.

After a review of the findings presented in this study, the following conclusions are presented:

1. The findings of this study indicate that weight reduction will result through exercise alone, and without the use of a weight reduction diet. This finding was statistically significant at the .12% and .05% level of confidence.

2. From the findings of this study, there is a statistically significant increase in strength of nearly all the muscle groups tested. Since this study was built around a strenuous conditioning program, this finding was to be expected.

"From Other Journals"

N. W. Paul, "Radiohumeral Bursitis—Is It Traumatic?" *Industrial Medicine and Surgery*, 26:383-390, August, 1957.

Radiohumeral bursitis has been referred to as tennis elbow, golf elbow, and by many other names. These suggest that it is due to trauma, whereas a study of 314 cases indicate that it is a metabolic disorder similar to gout or rheumatoid arthitis. Trauma simply irritates already inflamed bursa. Treatment consists of a cock-up spling, no physiotherapy, change of diet to an antipurine regimen, and avoidance of all stimulants to the nervous system.

Ernest H. Betterman, "Therapeutic Advantages of Intermittent Traction in Musculoskeletal Disorders." *GP*, XVI: 84-88, November, 1957.

The ligaments and periarticular structures act according to the "Law of Functional Adaptation." (1) Weak and constant pull is therapeutically ineffective. (2) Strong and constant pull results in ligamentous overstretching and neuromuscular tension. (3) Intermittent, gradually increasing pull, with complete relaxation and maximum traction, restores anatomic and physiologic equilibrium. With a heavy pull continuous traction involves the possibility of cord or root damage. Rhythmic traction allows the use of a heavy pull over extended periods. It is useful in all non-inflammatory musculoskeletal conditions with muscle spasm, pain, periarticular tightening and articular derangement. It may be harmful in inflammations, infections, acute arthritis, neurosis, neurologic signs of disk protusion or trophic changes, acute torticollis, myositis and cases which respond to the first treatment with increasing pain.

David M. Zausmer, "The Effect of Cooling on Muscle Excitability." *Annals of Physical Medicine*, 4:144-147, November, 1957.

The center points of the abductor pollicis brevis muscles of 13 university students were electrically stimulated to determine the threshold voltage required to produce a muscle twitch. The subjects' hands were then immersed in cold running water for 1 minute. In 12 of the 13 subjects there was a decrease in muscle excitability.

Bert C. Wiley, "Balanced Foot-Weight for Quadriceps Exercises." *Archives of Physical Medicine and Rehabilitation*, 38:696, November, 1957.

The conventional quadriceps boot holds the weight so far distal to the ankle joint that when the knee is extended in the sitting position an excessive strain is placed on the anterior tibial muscle, accentuating any tendency to foot-drop. Also its calf-bearing plate obstructs circulation so severely as to prevent use of the optimum strength of the quadriceps. In the balanced foot-weight described in this article the weight is localized in line with that of the transverse axis of the ankle joint. This both obviates the disadvantages of the conventional boot and affords the advantage that gradations of stress may be placed upon either the foot invertors or evertors by using a different amount of weight at the medial and lateral aspects of the foot.

Marshall T. Newman, "Man and the Heights." *Natural History*, LXVII:9-19, January, 1958.

At two or three miles above sea level the air contains only two-thirds to one-half the oxygen at sea level. The Andean Indians have huge chests, which overshadow the rest of their physical development. There is a decided expansion of the lower part of the rib cage and a lowered diaphragm. The alveoli are permanently dilated to afford maximum surface for oxygen absorption, and the capillary bed is doubly rich. These Indians average 2 quarts (40%) more blood than their sea-level cousins. There is a doubling of weight of hemoglobin and each individual red cell is larger. An abnormally high concentration of myoglobin is thought to be present. The more viscous blood resulting frm the increase in red cells is pumped by a larger heart. Heart rate is slow and blood pressures are low. The Indians' stocky body build reduces blood transport distance.

Ednita P. Bernabeau, "Science Fiction: A New Mythos." *The Psychoanalytic Quarterly*, 25:527-535, 1957.

In the reader of detective story, anxieties are initially intensified, followed by a feeling of release, masochistic gratification is received by identifying one's self with the victim, and an unconscious need for unraveling the mystery of the primal scene and mastering the trauma which it represents is met. The stereotyped plot and action of the western afford the reader an opportunity to relive and work through his oedipal conflicts. Science fiction is a vehicle for the expression of primitive, infantile fantasies of defence. The oedipal conflict is more threatening and is met by severe regression to primitive ego mechanisms and pregenital libidinal levels.

Editorial, "Iowa Breakfast Studies." *Industrial Medicine & Surgery, 26:485-486*, October, 1957.

Studies at the University of Iowa of breakfast eating habits showed omission of breakfast was reflected in poorer physiologic and psychologic performance in the late morning hours. Coffee alone is not a satisfactory substitute. The content of breakfast is not a determining factor so long as its nutritional content is basically adequate. It was shown that 20-35 gm of protein was adequate. The omission of breakfast may handicap a weight reduction program, since it accentuates hunger and causes a loss of efficiency. A basic breakfast should provide one-fourth of the daily caloric requirement and one-fourth of the total daily protein allowance.

Marvin K. Opler, "Schizophrenia and Culture." *Scientific American*, 197:193-110, August, 1957.

No single set of symptoms can describe schizophrenia and it cannot be traced to any one specific cause. Sullivan observed that it is "not a disease but a way of life." Studies of schizophrenia have focused too closely on the individual; it should be studied in terms of populations or cultures. The Irish family tends to be dominated by the mother. Active expression of emotions is frowned upon; sexual feelings are clouded with conceptions of sin. The Irish male is apt to be quiet, repressed, shy of women and given to fantasy as an outlet for his emotions. The Italian home is dominated by the father. Emotions are allowed free expression and no guilt is attached to sex. The Italian male is excitable, given to acting out his emotions and sometimes hostile to his father and older brothers. Exaggeration of these stresses may lead to characteristic mental disorders among individuals of the group and analysis of these stresses should enable us to predict what shapes their schizophrenias are likely to take. Studies of two groups of patients at the V.A. Hospital at Montrose showed that this was the case. Most schizophrenics have a homosexual conflict. In the Irish patients homosexuality was latent but repressed. They fled from their identity as males through fear of the mother, and repressed their homosexuality because sexuality in general is inhibited in the Irish culture. The Italians rejected a male role out of hostility to their fathers and brothers, but were overt in their actions because of their greater readiness to act on sexual impulses. The Irish were tormented with preoccupations of guilt about sex, whereas the Italians had no such problems. The Irish were passive, compliant, withdrawn and fearful. The Italians were assaultive, suicidal and rebellious against authority. The Irish tended to elaborate and fixed delusions; the Italians showed few delusions and tended to direct expression of feelings. The Irish tended to alcoholism, while the Italians tended to hypochondria. Each of these patterns bears the imprint of the underlying family experience and pattern of stress.

Curt P. Richter, "On the Phenomenon of Sudden Death in Animals and Men." *Psychosomatic Medicine*, XIX:191-198, May-June, 1957.

In 1942 Cannon published a paper entitled "'Voodoo' Death" (reprinted in above issue of *Psychosomatic Medicine*) in which he postulated that death from fear results as a consequence of the state of shock produced by the continuous outpouring of adrenalin. Such individuals might be expected to show manifestations of stimulation of the sympathicoadrenal system, such as rapid respiration, rapid pulse and a hemoconcentration resulting from loss of fluids from the blood to the tissues. However, studies of rats confined in water jars showed a slowing of heart rate, a slowing of respiration, and a lowering of body temperature. Ultimately the heart stopped in diastole after having shown a steady gradual decrease of rate. These signs are characteristic of the so-called "vagus death" which is a result of overstimulation of the parasympathetic system. The situation of these rats did not demand "fight or flight;" rather it was one of hopelessness and the rats literally "gave up." Emotional conditioning by immersing the rats for only a few minutes at a time so that they learned the situation was not hopeless resulted in the rats becoming aggressive and showing no signs of "giving up." The victim of voodoo presumably dies from parasympathetic causes and civilized men are probably more resistant to such reactions than are primitive men. Instances of sudden death from fright, sight of blood, hypodermic injections, sudden immersion in water, and unexplained deaths of healthy soldiers probably result from this phenomenon.

Carl M. Fellhauer, "Foot Instability in Childhood." *GP*, XVI: 88-92, October, 1957.

Untreated pes planus of childhood may result in secondary disturbances of all the joints of the lower extremities and in low back problems in adult life. In walking the child rolls off the side of the great toe and the first metatarsal-phalangeal joint, instead of using the great toe as a "take off." This causes progressive stress and strain. He tends to stumble and fall; to become irritable and unable to participate in normal physical activities. Children should be kept in high top shoes until approximately the age of five, not because such shoes give better support but because they lessen the tendency for the heel seat to become rounded and the counter weakened. The first metatarsal-phalangeal joint should lie directly behind the widest part of the shoe. A 1/8 to 3/16" raise is placed between the inner and outer layers of the shoe sole from heel to toe on the great toe side of both shoes. Wear should be lateral to a line drawn the length of the shoe through the center of the heel. The length of the time necessary for correction is usually directly proportional to the time required for the muscles of the lower extremity to develop to the point that the child can maintain proper mechanical alignment. Arch supports have no value in correction.

Weddell, G., "Discussion on Referred Pain." *Proceedings of the Royal Society of Medicine*, 50:581-586, August, 1957.

Recent observations support the hypothesis that there are no specific pain nerves. It may be suggested that when the number of impulses from the free nerve endings in a given zone rise excessively, are maintained, evoke excessive excitation centrally, and reach the "pain center," pain is induced. Referred pain is associated with cutaneous hyperalgesia, superficial and deep tenderness, and a local muscular spasm. One theory is that referred pain is due to events taking place in the periphery alone, but whether the postulated neuromechanisms actually exist is unknown, and the theory fails to account for certain well-known phenomena. The second theory is that referred pain is due to some mechanism located in the CNS. It assumes that a proportion of cutaneous and visceral afferent fibers each converge upon one and the same neuron in the CNS. If pain ascends in the anterolateral column of the cord to the thalamus and thence to the "pain center" in the brain via a chain of neurons, convergency may take place at any neuron in the course of a particular chain. Provided that peripheral axons from different regions such as the gut and deep tissues converge on to a neuron which also receives impulses from the skin, it seems clear that the phenomena of referred pain can be satisfactorily explained on the basis that the mechanism is situated in the CNS.

Mostafa Hamdy, Fred E. Deatherage and George Y. Sinowara, "Bruised Tissue. I. Biochemical Changes Resulting from Blunt Injury." *Proceedings of the Society for Experimental Biology and Medicine*, 95:255-258, June, 1957.

A bruise is a tissue injury without laceration usually produced by a blunt object, resulting in rupture of the vascular supply and accumulation of blood and fluid. Injury was inflicted on 55 cattle by two blows of a seven pound sledge hammer over three feet in ½ sec. Observations were made of the bruised area for nine days after injury. At various intervals the animals were slaughtered, and the control areas excised and subjected to various tests. There was an increase of extrastromal hemoglobin during the early stages of healing in the bruised tissue, apparently resulting from the destruction of red blood cells which escaped from the circulation upon rupture of the capillaries. There was an increase in iron content, indicating that the hemoglobin was catabolized in the tissue by release of its iron. There was an absence of bilirubin immediately after brusing, a rapid increase three or four days later, followed by a rapid decrease. Bilirubin seems to be a degradation product from the catabolism of free hemoglobin. Increase of bilirubin concentration coincided with the orange color usually observed during the healing process of a bruise. Healing was evident grossly in seven days, but biochemical values did not return to control levels until the ninth day.

Unless noted otherwise, all abstracts have been prepared by Philip J. Rasch, Ph.D.

Book Reviews

"Textbook of Human Anatomy," edited by W. J. Hamilton. (New York: St. Martin's Press, 1956. 1022 pp. $16.50)

Gray's *Anatomy of the Human Body* is so well established as the definitive text in its field that it comes almost as a surprise to find a new book on the subject. The six authors of this work offer three reasons for producing it: (1) the progressive expansion of the medical curriculum requires a reduction in the amount of factual detail; (2) a closer correlation between the study of structure and of function is needed; and (3) the student should be introduced to the wider biological implications of anatomy. The first two objectives have been accomplished by pruning away minute anatomical details and by stressing kinesiological aspects. For example, the authors say that the long head of the biceps "takes origin within the shoulder joint from above the glenoid cavity," whereas Gray states that it "arises from the supraglenoid tuberosity at the upper margin of the glenoid cavity, and is continuous with the glenoid labrum." The present text then devotes seven and one half lines to the action of the biceps, whereas Gray compresses it into less than two lines. As a result of this change of emphasis the Hamilton book covers the skeleton, joints and muscles in 225 pages, whereas Gray devotes 437 to the same subject. Some of the space thus conserved is used to consider evolution, growth, and other biological considerations not found in Gray. The illustrations, by A. K. Maxwell, are generally excellent. As compared with Gray, they sacrifice detail and thereby gain in clarity.

The real strengths and weaknesses of a book of this type can be determined only by usage. The impression given this reviewer is that it might be more serviceable to corrective therapists than is Gray. Therapists seldom have need for knowledge of the minute details of origin and insertion, but do require a thorough understanding of muscular actions. From this point the emphasis in Hamilton's work seems better designed to meet their requirements than is that in Gray. Therapists considering buying a text on anatomy should give this volume careful consideration before making a purchase.

—PJR

"A Short History of Anatomy & Physiology From the Greeks to Harvey," by Charles Singer. (New York: Dover Publications, Inc., 1957. 209 pp. $1.75)

There are numerous histories of medicine, but it seems extremely difficult to find historical materials bearing on the basic sciences of anatomy, physiology and kinesiology. This book, by a distinguished historian, does much to fill the gap so far as the early history of anatomy is concerned. Apparently most of it was originally given as a series of lectures at the College of Physicians in England about 1925 and then published under the title *The Evolution of Anatomy*. This edition is long out of print, and in 1956 the text was revised and is now again available to the student. As far as the reviewer knows, there is no other book which deals with this subject and with which it may be compared. In its behalf several points may be mentioned: it is interestingly written by an author who is in full command of his subject; it is profusely illustrated by reproductions of the early works on anatomy; the print is of good size and clarity; the book is inexpensive. For those of antiquarian tastes it would seem to be a bargain. A history of the development of these three basic sciences since Harvey would probably prove of greater interest to most corrective therapists and it is to be hoped that author Singer and publisher Dover will again combine their talents to make such a text available.

—PJR

"No Man Stands Alone," by Barney Ross and Martin Abramson. (Philadelphia: J. B. Lippincott Company, 1957. 256 pp. $3.95)

This is the autobiography of Barnet Rasofsky, better known as Barney Ross, written in collaboration with a former correspondent for *Stars and Stripes*. It is an exciting, warm and moving story, sympathetically told. Ross, the son of immigrant parents, was raised in the ghettos of New York and Chicago. The brutal murder of his father broke up the family, and the youth came perilously close to affiliating with the Capone mob. Only the fact that amateur boxing provided an outlet for his aggressive drives and led to a means of obtaining the money necessary to reunite the family saved him from a life of gangsterism. Eventually Ross became a professional boxer and held two world titles simultaneously. After the bombing of Pearl Harbor he enlisted in the Marine Corps. Ross proved a hero on Guadacanal, but both his body and his mind broke under the strain. He was given morphine for sedation and finally contracted the habit. As every newspaper reader knows, he eventually took the cure and has since devoted much of his time trying to help other addicts escape from their bondage. This is good reading; once started the reviewer could hardly put the book down. In his opinion it establishes Ross as a leading contender for this Association's annual award to the person who has contributed most to his own rehabilitation and thus given inspiration to others.

—PJR

"Anatomies of Pain," by K. D. Keele. (Springfield: Charles C. Thomas, Publisher, 1957. 196 pp. $5.50.)

Dr. Keele has here attempted a study of pain; the treatment of which he states to be one of the oldest of human needs. Only in recent years has pain been viewed as a problem in itself, and the stated purpose of the book is to show the manner in which the "changing ideas on the anatomical and physiological basis of pain have flowed as a continuous process from the most ancient medicine until the present day." Beginning with the earliest and most primitive conceptions, which considered the heart to be the seat of all the senses, we are led through the contributions of Chinese, Indian, Egyptian, and Greek thought to the period following the death of Aristotle, whose physiology of sensation was then demonstrated to be untenable. At this point in history the theory of the central nervous system as a basis of sensation came into existence, largely due to the efforts of Galen, although these works were largely submerged during the "Dark Ages" under the shadow of Aristotle's earlier concepts. By the 15th Century knowledge began to accumulate through the studies of Leonardo da Vinci, Harvey, Descartes, Hobbes, Willis, Gover, and others, until we have the 20th Century contributions of the autonomic nervous system and centralization of the sensorium within the brain. The newer concepts of biochemical aspects of sensation are just beginning to be appreciated and leave many questions yet to intrigue other searchers.

For interesting reading of history, this book is at least average. For its presentation of the stream of thinking in the idea of pain it is highly recommended.

—MLB

"An Inventory of Social and Economic Research in Health," Sixth Edition. (New York: Health Information Foundation, 1957. 327 pp. Paper.)

The format of this book is similar to that of previous years. Under the headings of Health Levels, Mental Health, Sociological Factors in the Field of Health, Health Facilities, Health Services, Personnel in the Field of Health and Economic Factors in the Field of Health, research problems, projects and publications, if any, are briefly described. The book is an essential tool for any one interested in or contemplating research within the areas which it covers.

—PJR

"Recovery from Schizophrenia: The Roland Method," by John Eisele Davis (Springfield, Ill., Charles C. Thomas 162 pp., $4.75)

The author has set himself the task of describing the history and character of the method of working with withdrawn psychiatric patients developed by Paul Roland and which has come to be known as the Roland Method.

The method begins with the effort to promote the relaxation of the withdrawn mute patient on the treatment table. Through the use of unlimited patience in a gentle, non-forcing approach, a constant friendly interest and encouragement in a low voice, Paul Roland has been able to bring about the patient's participation in simple physical activities and to introduce a group program of gradual re-education which, in most instances at least, restores the patients' capacity for a more adequate range of human responses than he has been showing.

There are included in the book three evaluative studies of the effectiveness of this method, one at the Veterans Administration Hospital at Topeka, Kansas, one at VAH Downey, Illinois, and one at VAH Chillicothe, Ohio. Each of these evaluations revealed evidence for the value of this approach in increasing the range and normality of responses of withdrawn chronic schizophrenic patients. The subjects have included patients who have been mute for years and who have ceased to be mute and withdrawn under treatment.

Problems of utilizing this approach in a public hospital setting relate to the highly favorable staff-patient ratios necessary to its success, to the persistent effort required and to the typically slow rate of the progress. With present staffing ratios in mental hospitals it may be inevitable that there is some negative reaction to the concentration of so much effort on so few patients, for this concentration necessarily occurs at the expense of other patients. On the other hand, in judging the value of a program such as this, in a field where optimism is difficult to maintain, we should certainly not overlook the importance of current and repeated evidence that the stabilized withdrawn chronic schizophrenic patient can be led, sometimes, to a functional recovery, and usually to a level of functioning definitely beyond that at which he has become stabilized.

—RLJ

"Fear: Contagion and Conquest," by James Clark Moloney. (New York: Philosophical Library, 1957. 140 pp. $3.75)

The author, a psychoanalyst, advances the thesis that "emotionally stable, normally integrated, emotionally mature adults develop by being afforded properly measured mothering by relaxed loving mothers throughout the first three to five years of their lives." He claims that if the mother is normal and non-neurotic but is made tense by real dangers and exposes the baby for the first five years to these tensions, the child will develop into a neurotic adult. Moloney then establishes his definition of emotional maturity and immaturity and its relationship to neurosis. He continues the proof of his theory through a logical, sociological approach. He compares the culturally displaced persons and the culturally fit through incidents related to the Chinese, Japanese, Jews, Okinawans, and Hawaiians, to arrive at his conclusions.

The book is an interesting psycho-sociological approach to an interesting subject.

—HJB

"Employment of the Physically Handicapped," compiled by Joan A. Donnelly. (Washington, D.C.: U.S. Government Printing Office, n.d. 93 pp. 35c. Paper)

This is a revision of Steele and Stephens *Employing the Physically Handicapped*. Material on this subject published since 1950, plus a few earlier items, is covered in the form of annotated bibliographic entries. Most of the papers itemized were published in the United States. A few films and some selected biographies are included, but publications dealing with the medical aspects of rehabilitation have been excluded. It should prove a handy guide to the literature for employment officers.

—PJR

"The Techniques of Judo," by Shinzo Takagaki and Harold E. Sharp. (Rutland: Charles E. Tuttle Company, 1957. 143 pp. $3.75.)

The qualifications of the senior author to write a book on judo are remarkable. A personal pupil of the revered Jigoro Kano, Takagaki is one of the few masters to attain the 8th grade. The original text was prepared while he was teaching at Santiniketan University at the invitation of Rabindranath Tagore.

The book is a detailed guide to the sport. It is profusely illustrated—some pages having as many as ten photographs. In general the authors describe an offensive maneuver and follow it with instructions for a counter-maneuver. A unique feature is their emphasis of "chain wrestling"—i.e., suggestions for appropriate moves in cases where the primary attack fails. This alone is worth the price of the book to any judoka.

We might quibble over one anatomical point. The authors state that strangulation technics apply pressure to the jugular veins and cut off the supply of blood to the head. It seems probable that they actually apply pressure to the carotid sinuses. (Wright, *Applied Physiology*, p. 740.)

Considering the quality of the paper and the number of photographs, it is difficult to understand how this volume could be published at such a low price. It is unqualifiedly recommended to everyone interested in judo, particularly those actively competing in the sport.

—PJR

"The Psychology of Personal Adjustment," by Roger W. Heyns. (New York: The Dryden Press, Inc., 1958. 548 pp. $4.90)

This book was written for college students as a second-year course in the field of psychology. The emphasis is chiefly directed toward that area commonly referred to as mental hygiene, or, as the title designates, personal adjustment. The volume is divided into two sections. The first, entitled "Basic Concepts," contains fundamental psychological definitions and information concerning adjustment, frustration, mechanisms, motivation, emotions, and learning. The second part, "The Genetic Sequence," presents the growth and developmental processes of the human being, including the chronological divisions of infancy, childhood, adolescence, the young adult at college level, marital adjustment, and the aging process.

This book contains a tremendous amount of psychological technical information, and is interesting reading in spite of the fact that it is a text. Two factors are quite noticeable throughout the book: (1) there were comparatively few case studies (descriptive examples through this media is a technique usually resorted to in psychological texts), and (2) most of the references, both books and articles were dated prior to the 1950s. Nevertheless, the book will probably serve its purpose quite satisfactorily.

—HJB

"Recreation, Medicine and the Humanities," by Joseph B. Wolffe. (Chapel Hill: University of North Carolina, 1957. 13 pp. Paper.)

This is the opening address given at the Third Southern Regional Institute on Hospital Recreation. Wolffe contends that too much stress has been laid on the scientific aspects of medicine, whereas clinical findings must always be interpreted in terms of the individual, particularly in relation to his capacity for performance. Recreation therapists, he says, are capable of making clinical observations, and the doctor can learn from them about the physiologic and therapeutic effects of various modalities. Wolffe then discusses some aspects of activity for cardiovascular cases and the prerequisites for a department of recreation therapy. While he discusses only recreation therapists, his whole address could apply to corrective therapists by simply altering a single word. It would be interesting to know what distinction he draws between the two therapies.

—PJR

"The Science of Skin and Scuba Diving," The Conference for National Co-operation in Aquatics. (New York: Association Press, 1957. 306 pp. $3.95)

This book is the first guide on the development of skill and safety in the art of skin and scuba diving. Eleven authorities from the Army, Navy, Medicine, and experienced divers and trainers contributed their knowledge to make this a most interesting and informative text. The material covers suggestions for the necessary basic requirements as far as physical and medical status and swimming ability are concerned. Elementary and advanced techniques for safe diving are discussed. The physical, physiological and medical aspects of diving are written up in an easy readable manner. A chapter on environment and marine life adds to the interest of the book. The discussion of skills, first aid, types and use of underwater apparatus contributes to making this a well rounded piece of work. The manuscript is concluded with a glossary of terms in skin and scuba diving. Special recognition must be given for the many illustrations that provide added interest to this manual. Both amateur and professional divers will find this book to be a valuable addition to their libraries.

—HJB

"Psychopathic Personalities," by Harold Palmer. (New York: Philosophical Library, 1957. 179 pp. $4.75)

In these nine clinical essays a British psychiatrist in his own very British, very personalized way briefly expresses his opinions on the etiology, diagnosis and treatment of psychopathic personalities, schizophrenia, depressive states, obsessions, hysteria, the epilepsies, the tension syndromes and the paranoid states. Although written with typical British charm, the author is given to overly verbose elaboration and employs terminology now considered obsolete in the United States. This reviewer finds it difficult to comprehend why the book is entitled *Psychopathic Personalities* when the only essay on the subject consists of but twelve pages at the beginning of the text.

Any value which this sketchy presentation of essays may have is as exposition of British literary style applied to abnormal psychology. An index completes a volume which can only be considered as an accessory library addition representing a particular literary style which would be better applied to philosophy.

—DCL

BOOKS RECEIVED

"Research Expenditures of Foundations and Other Nonprofit Institutions, 1953-54. (Washington, D.C.: National Science Foundation. 1957. 26 pp. Paper)

Scientific research and development expenditures of health agencies and other nonprofit organizations.

"Second Annual Report of the Joint Commission on Mental Illness and Health," (Cambridge: Joint Commission on Mental Illness and Health, 83 pp. Paper.)

Report of study projects underway under auspices of Joint Commission.

"Traumatic Paraplegia, A Selected Bibliography—1956 Supplement," (Washington: Medical and General Reference Library, Veterans Admin. 9 pp. Paper.)

Available free from Medical and Gen. Reference Library, Room 974, Veterans Admin. Central Office, Washington 25, D.C.

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Chapter Activities

California Chapter

The California Chapter, APMR, in conjunction with its West Coast counterparts of the American Assoc. of Rehabilitation Therapists and the Assoc. of Medical Rehabilitation Directors and Coordinators held a meeting and workshop on March 15 at the Long Beach VA Hospital. Business meetings of the sponosring organizations were held at the beginning of the morning session after which members of the respective organizations attended workshops in their specialties.

Members of APMR discussed as their major topic, "Needs for Curricular and Clinical Training in Corrective Therapy and Adapted Physical Education." Discussion leaders were Richard Fowler, Chief CT, Wadsworth Gen. Hosp., Thomas C. Meyer, CT, Brentwood NP Hospital and Clifford Loose of the California Rehabilitation Institute.

During the afternoon all members attended a panel discussion on improving communications. Rudy Jahn and Dr. Carl Haven Young represented APMR on this panel.

Texas-Louisiana Chapter

A joint conference on rehabilitation will be held at the Driskill Hotel in Austin, Texas on Friday and Saturday, April 11th and 12th, 1958. The conference is being jointly sponsored by the Texas-Louisiana Chapter of the Association for Physical and Mental Rehabilitation, the Texas Chapter of The American Association of Rehabilitation Therapists and Specialists, Texas members of the National Association of Recreational Therapists, and the Department of Required Physical Education, University of Texas.

The theme is concerned with "The Motivational Forces of Rehabilitation". This topic will be explored through the use of group workshops to be held on Friday, and individual papers will be presented on Saturday. Commercial and organizational exhibits will be displayed.

Feature speakers of the conference are Dr. Melvin A. Casberg, Vice President of Medical Affairs, University of Texas and Dr. Hubert W. Smith of the Law Science Institute, University of Texas.

Approximately fifteen organizations in the rehabilitation field will be represented. The program is planned so that both lay and professional conferees may select workshops that may be of special interest to them.

Room reservations may be made now by contacting the Driskill Hotel, Austin, Texas.

News and Comments

NEW X-RAY MACHINE TAKES CROSS SECTIONS

A new technique for making x-ray films that assures more accurate location and x-ray treatment of cancer was demonstrated by Veterans Administration doctors Oct. 1 at the American Roentgen Society meeting in Washington, D.C. An ingenious x-ray machine produces films that show horizontal cross-sections or "slices" across the patient's body, and thus give much the same information as would living anatomical dissection of the patient. The technique, first developed in Europe but improved and adapted by the Bronx, N. Y., VA hospital, is known as *transverse tomography*.

The x-ray machine, or transverse tomograph, looks something like a dental chair. As the subject revolves, the x-ray tube pointing obliquely through the body obtains a horizontal cross-section image at any desired plane.

Such x-rays already have proved their value in fixing the exact location and size of tumors, according to Dr. Bernard Roswit, chief of the radiotherapy service at the Bronx VA Hospital.

Dr. Roswit and his associate, Dr. S. M. Unger, demonstrated their technique before the society with a photographic exhibit showing how the shape and location of tumors are easily and accurately pinpointed, and how other conditions not noted on standard x-ray films have been revealed in these three-dimensional radiographs.

The first studies were made at the VA hospital three years ago with a do-it-yourself device based on an Italian invention. Staff physicists, Stanley Malsky and Cyprian Reid, assisted in this research effort.

The present VA tomograph, a German invention, has only recently been imported to America. It fills the therapist's need of absolute accuracy when beaming high energy radiation or cobalt rays to avoid damage to adjacent healthy tissues, VA said.

Standard x-ray films might locate the tumor. But these films did not give views in the horizontal or cross-sectional plane for use in establishing the tumor's dimensions and depth within the body and its relationship to neighboring organs. This plane is essential for accurate treatment planning. Dr. Roswit explained that scientists heretofore had sought to establish these dimensions and location by reference to frozen cross-sections of human bodies. Since the frozen specimens never had the exact girth and anatomy of the living patient with cancer, absolute accuracy in planning his treatment was not possible.

The transverse tomograph eliminates this field of error by performing its own dissection and producing a completely accurate cross-section radiograph of the tumorous area. Furthermore, so-called "dark areas" of the body in the chest and abdomen now become accessible to x-ray exploration.

MONITOR MEASURES SURGICAL BLOOD LOSS

An electronic machine that enables doctors to know when a patient needs a blood transfusion during surgery has been devised by a Veterans Administration surgeon, VA has announced. Called a blood-loss monitor, the new instrument i n s t a n t l y, automatically, and continuously measures the amount of blood lost by a patient during an operation. It was originated by Dr. Harry H. LeVeen, chief of surgery at the VA hospital in Brooklyn.

Dr. LeVeen said measurements of blood loss made by the monitor are accurate to within one half of one percent. The machine is in use at the Brooklyn hospital for all heart surgery and for most operations for cancer, burns, and other conditions in which heavy blood loss is likely to occur, he said. The monitor is about two feet square.

Sponges and drapes used in surgery are dropped into a wire basket inside the machine and agitated in a measured amount of water to remove the blood. Other blood lost at the site of surgery is sucked into the same water through a tube. As blood is added to and mixed with the water, the electrical conductivity of the solution changes. The machine measures this conductivity and translates the changes into cubic centimeter measurements of blood loss. The cumulative blood loss is measured on a dial at the front of the monitor.

VA PLANS LONG-TERM CANCER SURVEY

Treatment for patients with cancer in Veterans Administration hospitals will be surveyed in a major project according to the agency. Dr. Roy A. Wolford, VA deputy chief medical director in Washington, D.C., said all 173 VA hospitals have begun a long-term survey to provide information on cancer patients at the rate of about 25,000 per year. The data will include material on diagnosis and results of treatment for cancer, clinical information needed for research and epidemiological studies, and statistics useful for planning purposes. Dr. Wolford said the hospitals will report follow-up studies of discharged patients, as well as information on patients under treatment.

Dr. Wolford said VA hospitals are admitting approximately 35,000 cancer patients yearly and have an average daily cancer patient load of more than 4,000. He added that a continuous increase in the number of cancer patients admitted to VA hospitals may be expected as the veteran population ages.

SAFETY RECORD SET BY EPILEPTIC EMPLOYEES

An industrial plant manned entirely by epileptics has just been granted a 20 percent reduction in its accident insurance rates because of its outstanding safety record. The two-year-old plant, Epi-Hab in Los Angeles, only one of its kind in the United States, employs about 50 workers with various forms and degrees of epilepsy. It manufactures aircraft parts and electronic components.

In a letter to Epi-Hab, its insurance company wrote: "In reviewing your accident experience for the past two years we find that your safety record far surpasses that of other industries having the same operations as are conducted by your company."

Epi-Hab began in 1950 as an experiment of Dr. Frank Risch, chief of the epilepsy rehabilitation service of the Veterans Administration center in Los Angeles. He found that 75 percent of veterans with epilepsy were unemployed and he wanted to see whether something could be done about it.

Originally, Dr. Risch recalled, Epi-Hab was an "experimental workshop" for epileptic veterans, "to determine what effect steady, gainful employment would have on control of seizures." In addition, he said, "we wanted to rehabilitate the epileptic economically—to prove to him and to the community that the affliction is not a 'taint'."

The experiment worked. Two years ago Epi-Hab came of age as an independent industrial firm, employing both veterans and non-veterans, and vying for business the same as any other private enterprise. However, to help get started, it did receive grants from the U.S. Office of Vocational Rehabilitation and from private individuals.

Dr. Risch, who continues to donate his time as the firm's project director, noted some employers "excuse themselves from giving work to epileptics on the grounds that insurance rates are higher for them, and that their seizures make them accident prone." He said "our own experience has proven that both these objections are greatly exaggerated. A record of seizures from our shop shows most of the attacks occurred during the first few weeks of employment. There seems to be a progressive decrease in seizure frequency and intensity as they gain confidence in themselves."

Seizures are dealt with casually at Epi-Hab. A worker is placed on a cot right in the shop, and is encouraged to go back to work as soon as the seizure is over. Time lost from work averages 32 minutes per seizure.

Other statistics compiled by the firm reveal the average income of employees before they started to work was $300 a year. At present, it is more than $3,000 a year. During the past two years, Epi-Hab employees have paid a total of $40,000 in income taxes. "The ultimate goal is to get these people into private industry," Dr. Risch said. "We have a waiting list of about 300 who want to go to work here." As a result of its success, Epi-Hab is opening similar industrial plants in Long Island, N.Y., and Phoenix, Ariz.

Contributions of Corrective Therapists to the Literature of their Profession

Psychiatric —Cont'd

Continued from this Journal 12:1:35, Jan.-Feb., 1958

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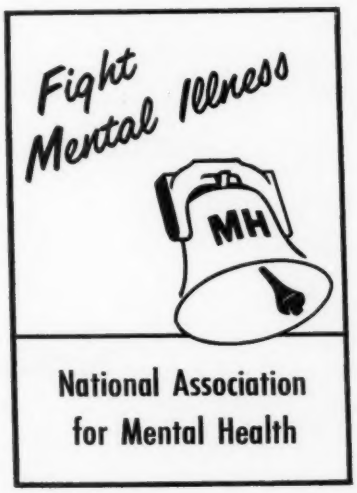

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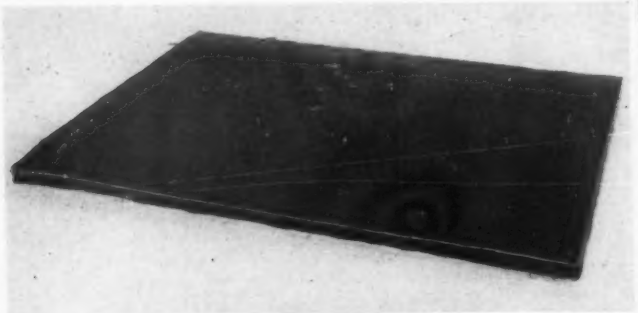

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